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(54) **CREATING VARIATIONS WHEN TRANSFORMING DATA INTO CONSUMABLE CONTENT**

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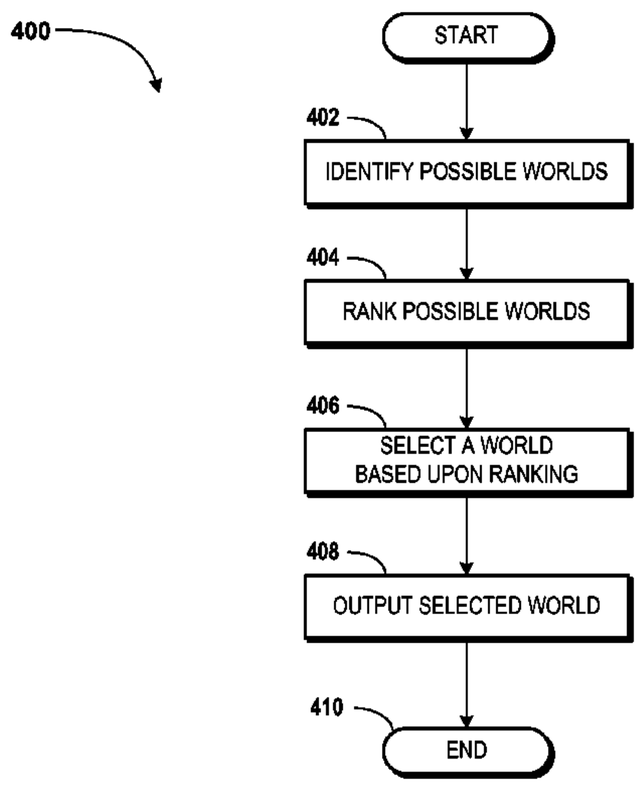
(57) **ABSTRACT**

Concepts and technologies are described herein for creating variations when transforming data into consumable content. In accordance with the concepts and technologies disclosed herein, a computing device can execute a transformation engine for transforming data into the consumable content. The computing device can be configured to analyze the data to identify relationships among data elements or other portions of the data, and to identify any possible approaches to transforming the data ("worlds") based upon the relationships and the data. The worlds can be ranked and selected based upon rank. The computing device can obtain rules associated with the selected and apply the rules to the data to generate the output. In some embodiments, the computing device can be configured to obtain and apply feedback regarding the world selection.

20 Claims, 8 Drawing Sheets



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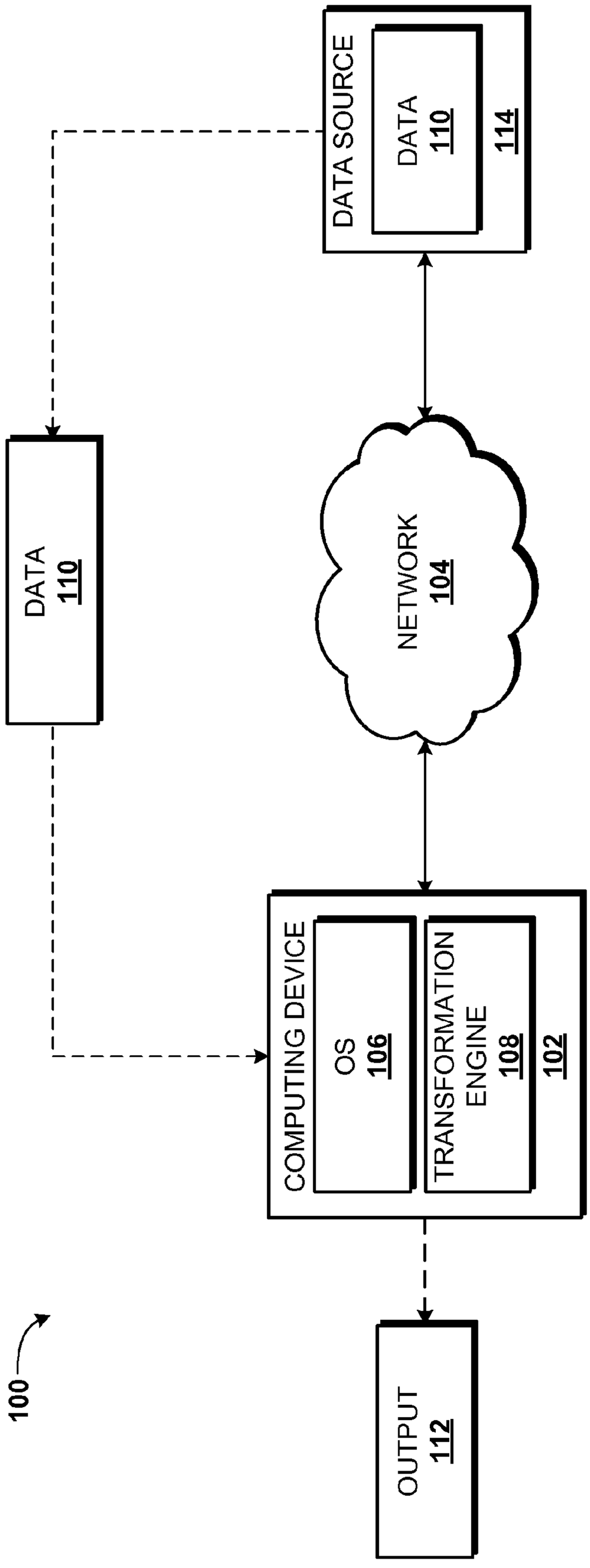
DATA SOURCE
DATA
110
114
NETWORK
104
DATA
110
COMPUTING DEVICE
OS
106
TRANSFORMATION
ENGINE
108
102
OUTPUT
112
100

FIG. 1

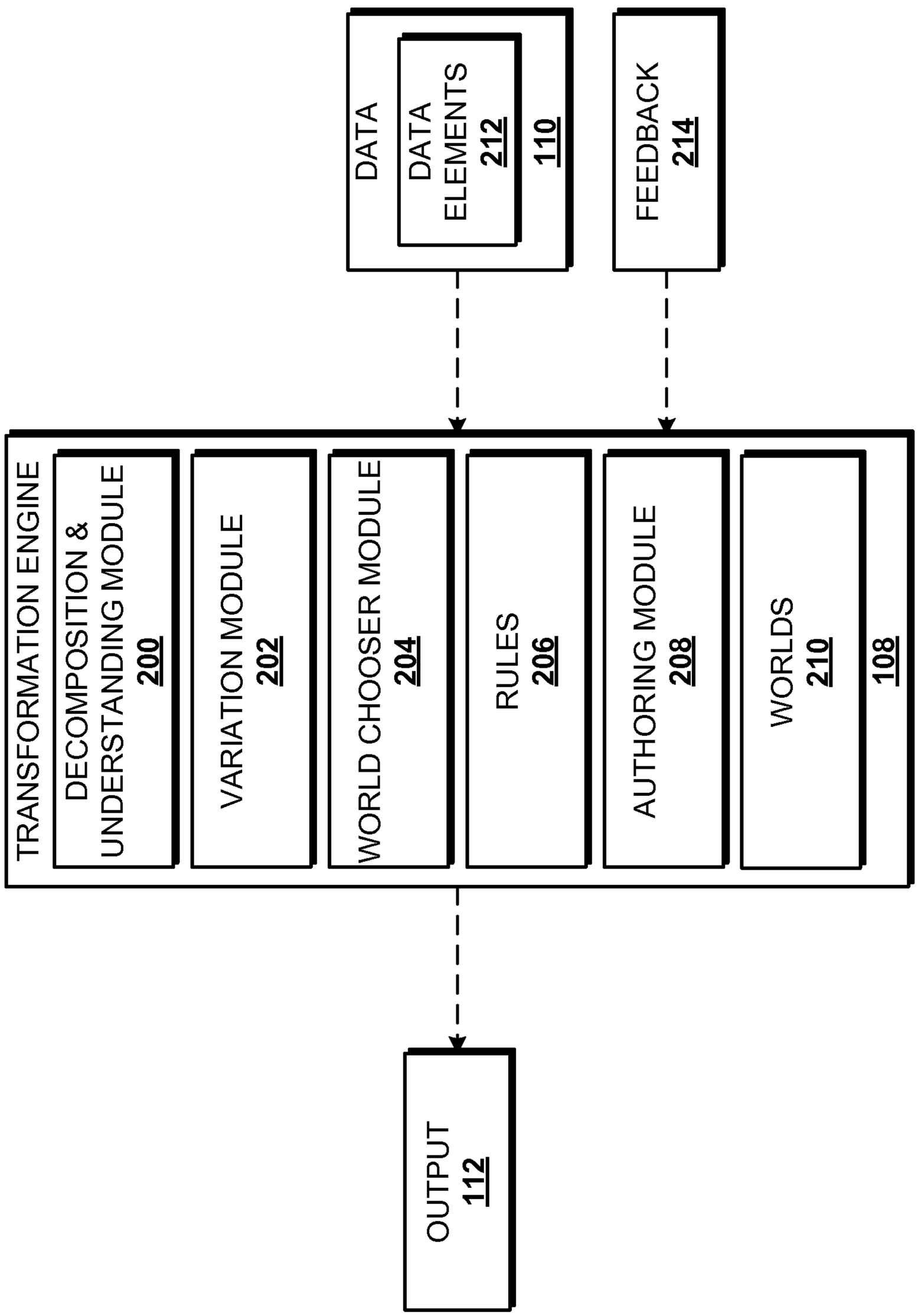
DATA
DATA ELEMENTS 212
110
FEEDBACK 214
TRANSFORMATION ENGINE
DECOMPOSITION & UNDERSTANDING MODULE 200
VARIATION MODULE 202
WORLD CHOOSER MODULE 204
RULES 206
AUTHORING MODULE 208
WORLDS 210
108
OUTPUT 112

FIG. 2

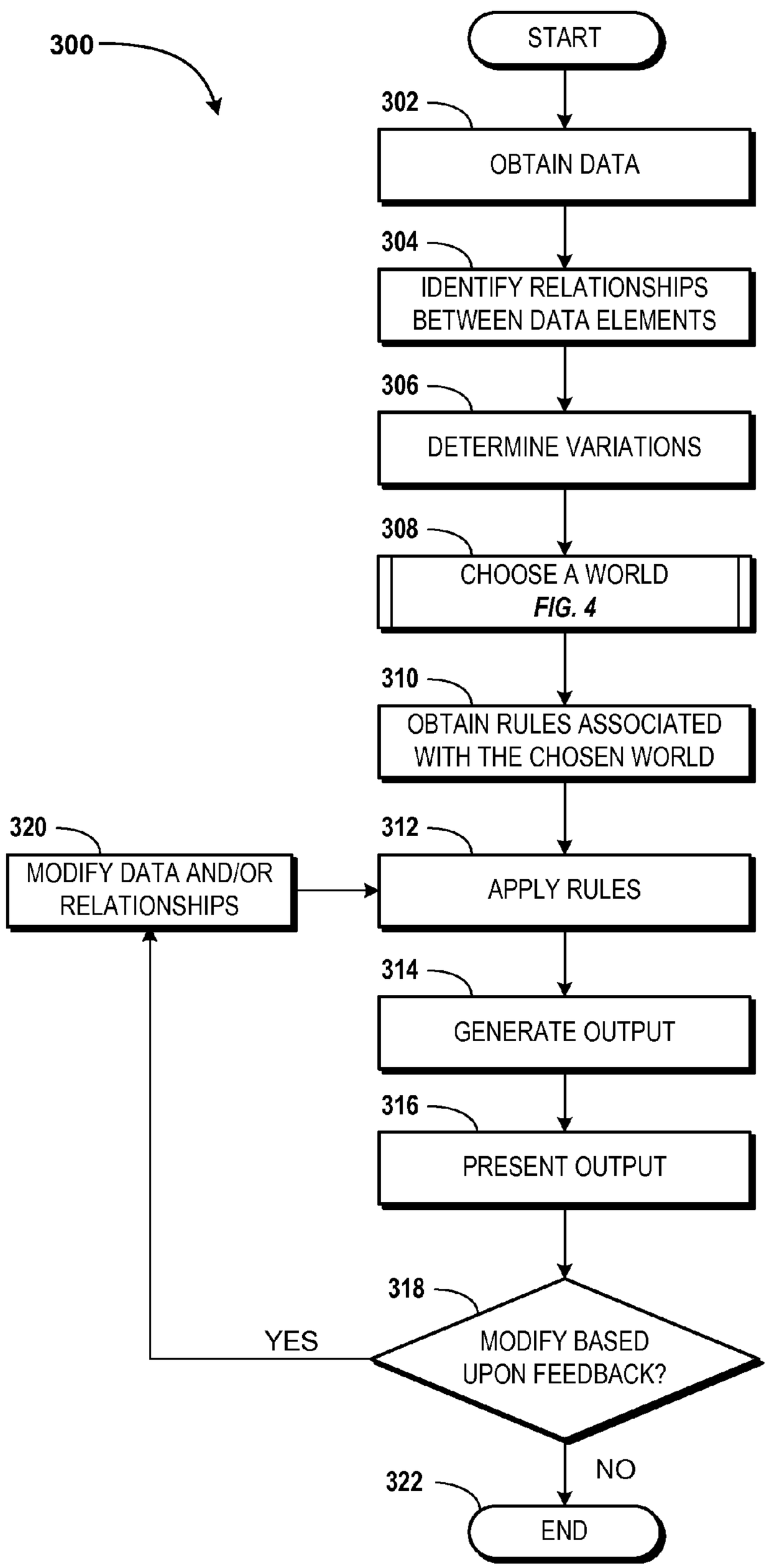
300
START
302
OBTAIN DATA
304
IDENTIFY RELATIONSHIPS BETWEEN DATA ELEMENTS
306
DETERMINE VARIATIONS
308
CHOOSE A WORLD
FIG. 4
310
OBTAIN RULES ASSOCIATED WITH THE CHOSEN WORLD
312
APPLY RULES
314
GENERATE OUTPUT
316
PRESENT OUTPUT
318
MODIFY BASED UPON FEEDBACK?
YES
NO
320
MODIFY DATA AND/OR RELATIONSHIPS
322
END

FIG. 3

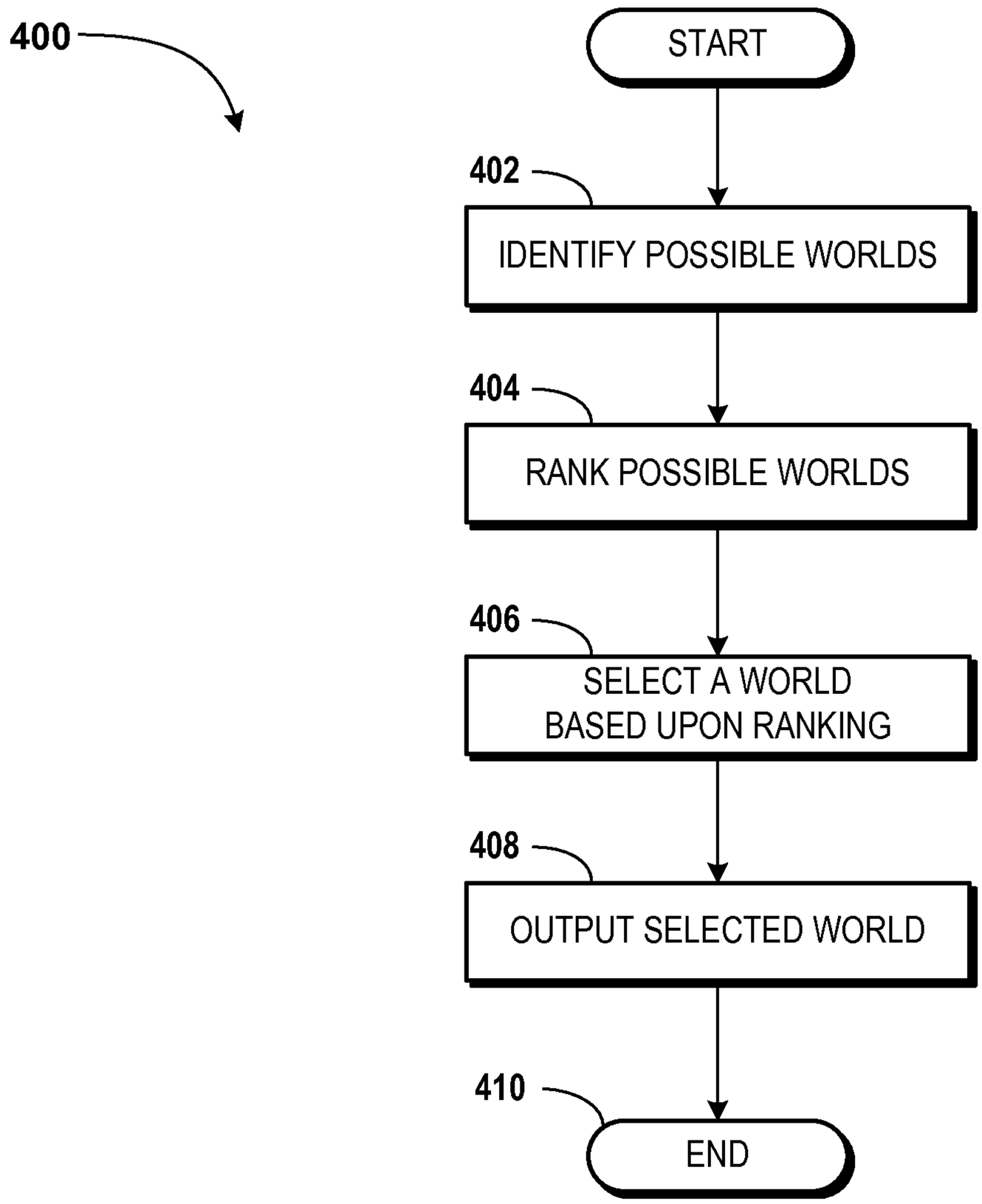
400
START
402
IDENTIFY POSSIBLE WORLDS
404
RANK POSSIBLE WORLDS
406
SELECT A WORLD
BASED UPON RANKING
408
OUTPUT SELECTED WORLD
410
END

FIG. 4

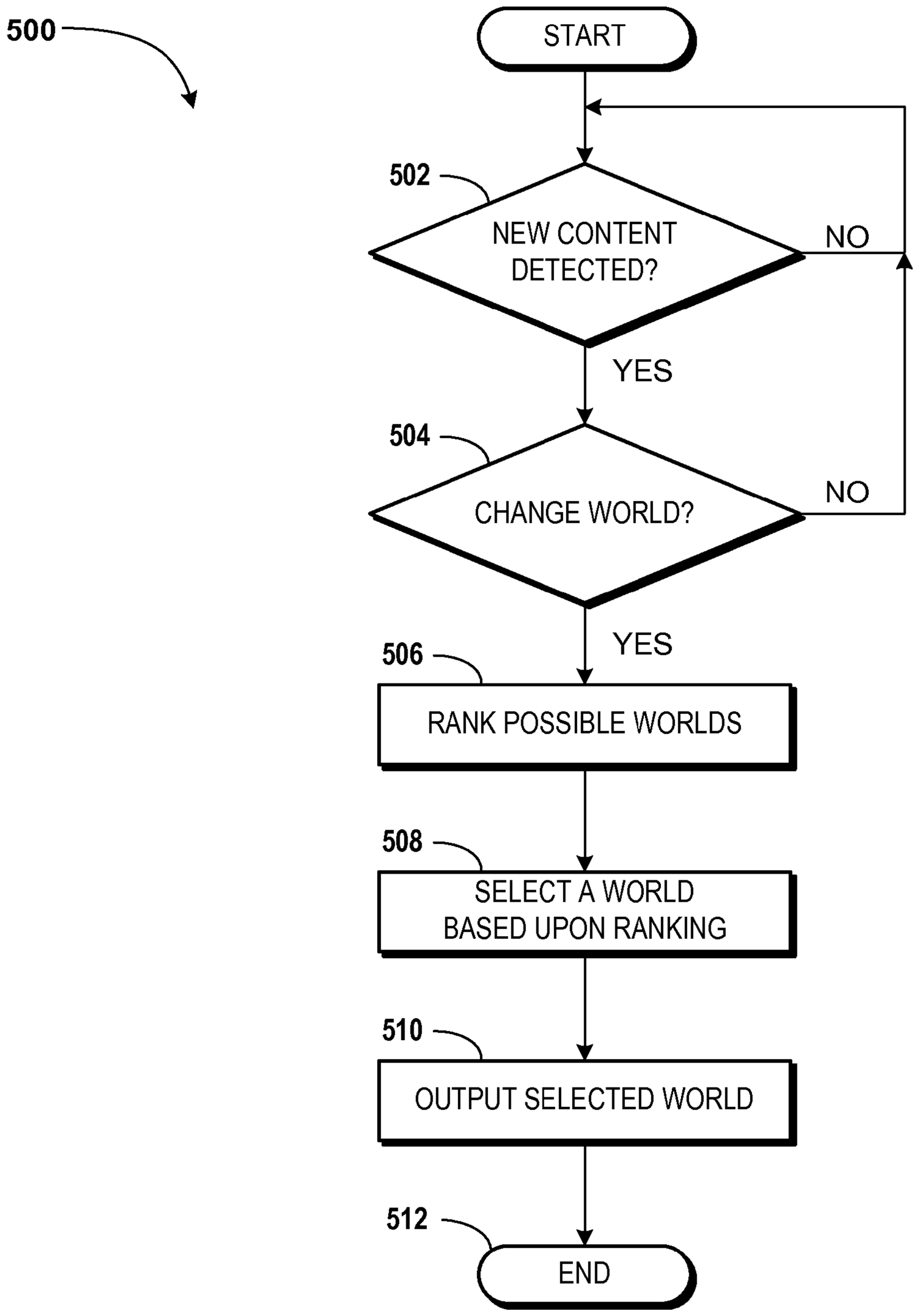
500
START
502
NEW CONTENT DETECTED?
NO
YES
504
CHANGE WORLD?
NO
YES
506
RANK POSSIBLE WORLDS
508
SELECT A WORLD BASED UPON RANKING
510
OUTPUT SELECTED WORLD
512
END

FIG. 5

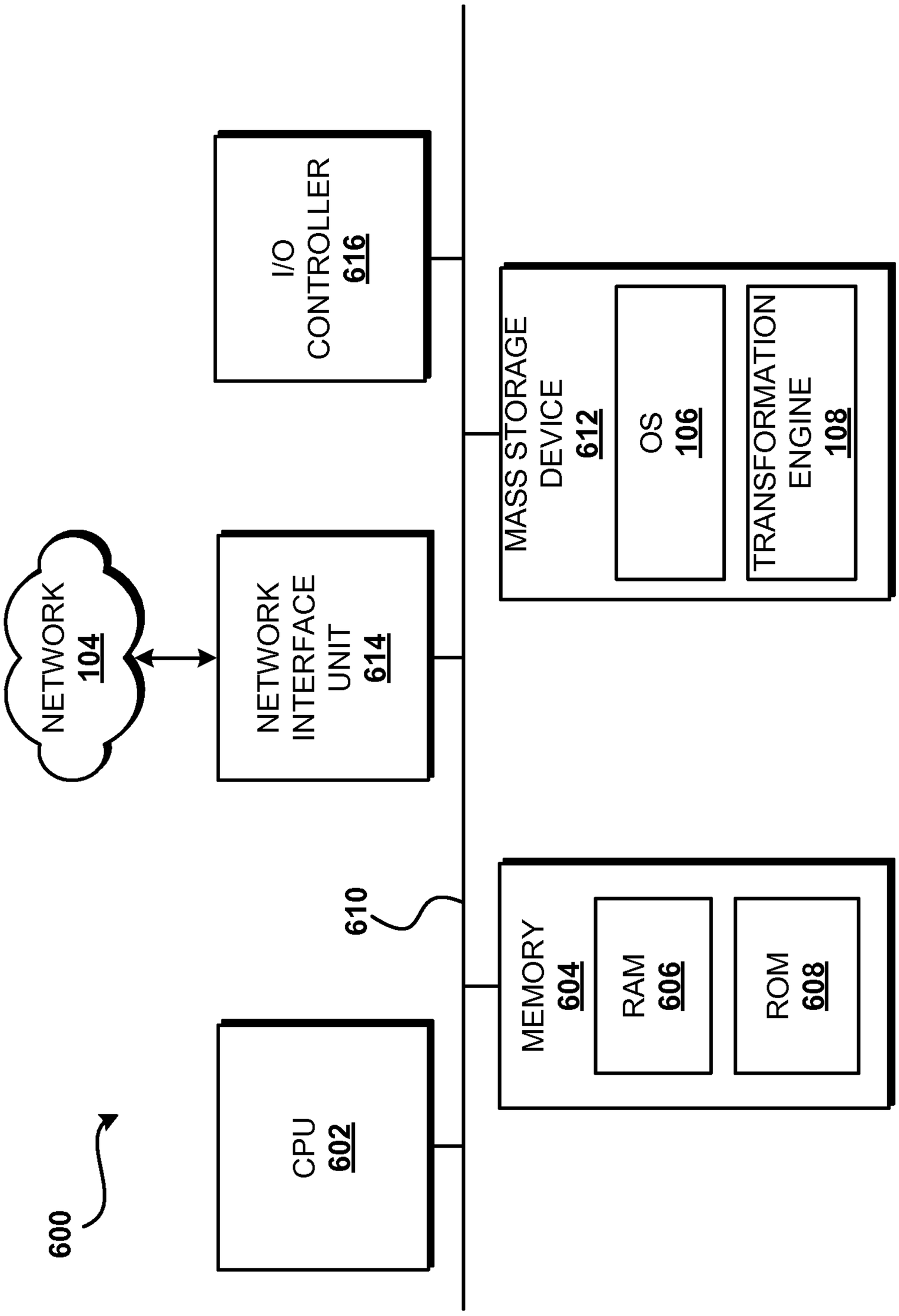
600
CPU
602
610
MEMORY
604
RAM
606
ROM
608
MASS STORAGE DEVICE
612
OS
106
TRANSFORMATION ENGINE
108
NETWORK INTERFACE UNIT
614
NETWORK
104
I/O CONTROLLER
616

FIG. 6

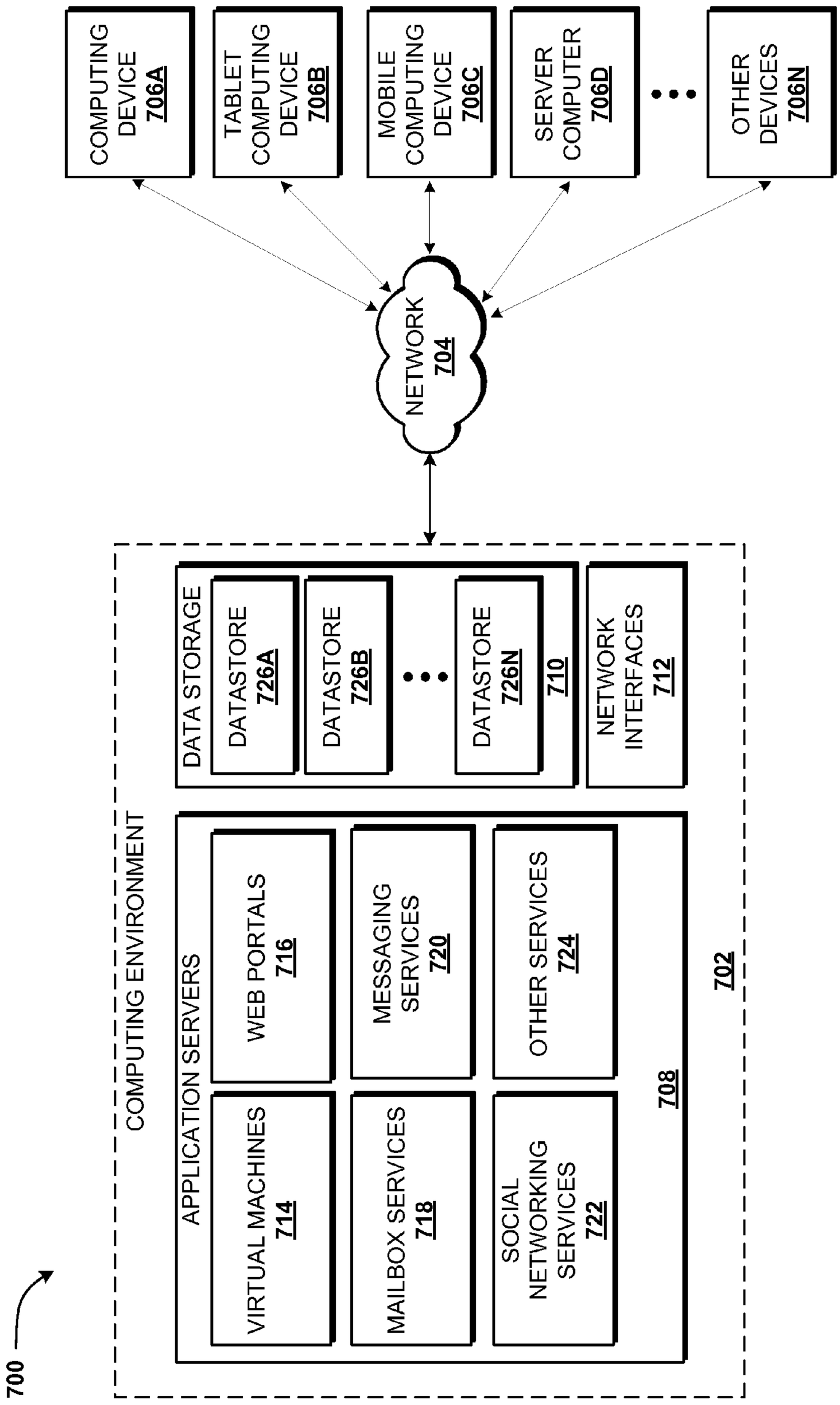
COMPUTING DEVICE 706A
TABLET COMPUTING DEVICE 706B
MOBILE COMPUTING DEVICE 706C
SERVER COMPUTER 706D
OTHER DEVICES 706N
NETWORK 704
COMPUTING ENVIRONMENT
DATA STORAGE
DATASTORE 726A
DATASTORE 726B
DATASTORE 726N
710
NETWORK INTERFACES 712
APPLICATION SERVERS
WEB PORTALS 716
MESSAGING SERVICES 720
OTHER SERVICES 724
VIRTUAL MACHINES 714
MAILBOX SERVICES 718
SOCIAL NETWORKING SERVICES 722
708
702
700

FIG. 7

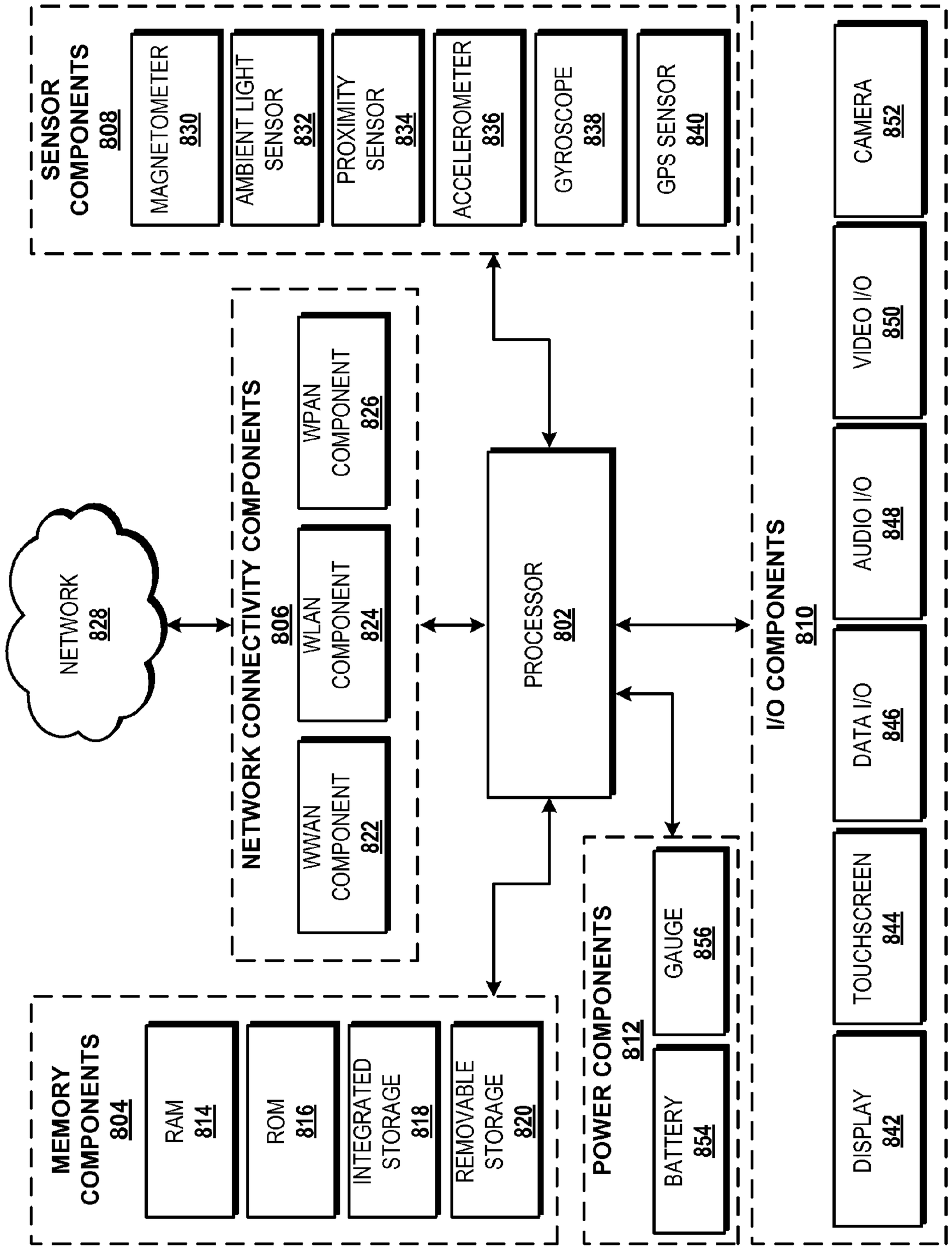
800
MEMORY COMPONENTS 804
RAM 814
ROM 816
INTEGRATED STORAGE 818
REMOVABLE STORAGE 820
POWER COMPONENTS 812
BATTERY 854
GAUGE 856
NETWORK CONNECTIVITY COMPONENTS 806
WWAN COMPONENT 822
WLAN COMPONENT 824
WPAN COMPONENT 826
NETWORK 828
PROCESSOR 802
SENSOR COMPONENTS 808
MAGNETOMETER 830
AMBIENT LIGHT SENSOR 832
PROXIMITY SENSOR 834
ACCELEROMETER 836
GYROSCOPE 838
GPS SENSOR 840
I/O COMPONENTS 810
DISPLAY 842
TOUCHSCREEN 844
DATA I/O 846
AUDIO I/O 848
VIDEO I/O 850
CAMERA 852

FIG. 8

CREATING VARIATIONS WHEN TRANSFORMING DATA INTO CONSUMABLE CONTENT

BACKGROUND

With the increasing availability and diversity of software that can be used to instantly publish information, data sharing has been revolutionized by allowing an increasingly diverse set of users to share increasingly diverse types of data at accelerated speeds, frequencies, and to expanding audiences. Thus, many users who create, generate, share, and/or publish data may or may not be well versed in design concepts that can be used to present data in a meaningful format for viewers. If these users take time to improve design characteristics of the presented data, the utility of the data may diminish due to subsequent data publication by that user or other users.

To meet these time-related challenges, some users may publish data in a simple document and/or may load the data into a presentation, video, or other output. Because the format chosen to present data may or may not be ideal, these presentations may lack enough information to be useful and/or may include too much information to be easily consumed by viewers. Thus, the challenges posed to users due to the increasing volume and frequency of data publication may affect the usefulness of the shared or otherwise published information.

While templates can be used to publish data, these templates may be standard to a particular software package and may or may not be well suited to a particular type of data published by a user. Additionally, users may want to distinguish their published data from other users by making their publication appear unique, thereby attracting and keeping a viewer's attention and/or giving the impression that the user generated the document himself or herself.

It is with respect to these and other considerations that the disclosure made herein is presented.

SUMMARY

Concepts and technologies are described herein for creating variations when transforming data into consumable content. As used herein, the term "consumable" can be used to refer to content that can be readily viewed, interpreted, or accessed by a user, viewer, or other entity. In some instances, the content or portions thereof can be arranged in accordance with hierarchical or logical relationships and/or in accordance with applied design rules. In accordance with the concepts and technologies disclosed herein, data can be obtained by a computing device. In some instances, the data can include a text file, a web page, a document, a presentation file, a spreadsheet, a video, a photo or other image, or another type of data. The data can be obtained in various formats and can be analyzed to identify relationships between data elements and/or portions of the data. The relationships can be used to identify hierarchies, emphasis, clusters, and/or to otherwise obtain an understanding of the data.

The computing device can determine how to introduce differences or variations to the data. The variations can include differences in animations, effects, layouts, color schemes, or other design variations. The computing device also can select a world for presenting the data. As used herein, the term "world" can be used to refer to an approach, model, or theme for presenting data. The computing device can be configured to identity multiple worlds that may be appropriate or applicable to the data, based upon the determined relationships, hierarchy, and/or types and instance counts of data, and can rank the possible worlds based upon various considerations. Based upon the ranking of the worlds and/or other considerations, the computing device can select a world for presentation of the data. The computing device can apply the data to the world using one or more sets of rules that define how data is translated into the world. In some embodiments, the rules can be tailored for each world and can define, for example, how data of a particular type is to be represented in the selected or chosen world.

Through application of the variations, visualization models, worlds, and/or rules, the computing device can generate output that includes the consumable content and that includes variations that can make the output appear distinguishable or even unique to viewers. The output can include a presentation, a document, a video, an interactive data output, or other data. In some embodiments, the computing device presents the output to a user or other entity and the user or other entity expresses preferences relating to various aspects of the output. Thus, for example, the user can express whether a particular aspect of the output is liked or disliked, and the computing device can be configured to apply the expressed likes or dislikes to the output. In some embodiments, the computing device can be configured to determine, based upon the user preferences, if the world used to translate the data is to be changed. The computing device also can be configured to store the preferences for future use.

According to one aspect, a computing device obtains data. The data can be obtained from a local or remote storage device such as the Internet, a server, or the like. The computing device can be configured to execute a transformation engine for analyzing the data, identifying relationships within the data, determining a visualization model, choosing a world, applying rules such as design rules associated with the world to the data, and generating the output. In some embodiments, the transformation engine can include or can be substituted for by a number of modules. The modules can include a decomposition and understanding module, a variation module, and a world chooser module. The transformation engine also can include representations of the rules for translating the data based upon the chosen or selected world, and the transformation engine can be configured to apply the rules to the data to generate output.

According to another aspect, the transformation engine can be configured to select the world by first determining worlds that can be used to translate the data. The worlds can be ranked by the computing device based upon various considerations. The computing device can select a world based, at least partially, upon the rankings, and apply the world to the data. If the data is updated, or if the computing device determines based upon feedback that the world is to be changed, the computing device can change or modify the world. As such, the computing device can be configured to generate the output and to modify the output based upon user preferences and/or based upon changes to the data transformed by the computing device. The computing device also can be configured to store the preferences for future use and/or application to other data.

It should be appreciated that the above-described subject matter may be implemented as a computer-controlled apparatus, a computer process, a computing system, or as an article of manufacture such as a computer-readable storage medium. These and various other features will be apparent from a reading of the following Detailed Description and a review of the associated drawings.

This Summary is provided to introduce a selection of concepts in a simplified form that are further described below in the Detailed Description. This Summary is not intended to identify key features or essential features of the claimed sub-

ject matter, nor is it intended that this Summary be used to limit the scope of the claimed subject matter. Furthermore, the claimed subject matter is not limited to implementations that solve any or all disadvantages noted in any part of this disclosure.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1** is a system diagram illustrating an illustrative operating environment for the various embodiments disclosed herein.

FIG. **2** is a block diagram showing additional aspects of a transformation engine, according to an illustrative embodiment.

FIG. **3** is a flow diagram showing aspects of a method for transforming data into consumable content, according to an illustrative embodiment.

FIG. **4** is a flow diagram showing aspects of a method for ranking and selecting a world for introducing variations to data, according to an illustrative embodiment.

FIG. **5** is a flow diagram showing aspects of changing a world for introducing variations to data, according to an illustrative embodiment.

FIG. **6** is a computer architecture diagram illustrating an illustrative computer hardware and software architecture for a computing system capable of implementing aspects of the embodiments presented herein.

FIG. **7** is a diagram illustrating a distributed computing environment capable of implementing aspects of the embodiments presented herein.

FIG. **8** is a computer architecture diagram illustrating a computing device architecture capable of implementing aspects of the embodiments presented herein.

DETAILED DESCRIPTION

The following detailed description is directed to concepts and technologies for creating variations when transforming data into consumable content. According to the concepts and technologies described herein, a computing device can execute a transformation engine for transforming data into the consumable content and introducing variations to the consumable content. In some embodiments, the computing device obtains data from a local or remote storage device such as a memory or server, the Internet, or the like. In some other embodiments, the data is generated at the computing device using an application program executing at the computing device. The computing device can be configured to execute the transformation engine to analyze the data. Via analysis of the data, the computing device can identify relationships within data elements or other portions of the data. The computing device also can execute the transformation engine to determine variations to apply to the data and to select a visualization model and/or world to apply to the data. In selecting the world, the computing device can determine possible worlds for the data, rank the possible worlds, and select a single world based upon the ranking of the possible worlds. The computing device also can execute the transformation engine to obtain rules associated with the selected or chosen world and to apply the rules to the data to generate output.

The computing device can be configured to obtain and apply input or feedback from a user or other entity. The feedback can be interpreted by the computing device to understand preferences of the user or other entity with regard to the output. The input or feedback can be obtained directly from the user or other entity and/or can be obtained in response to one or more prompts that can be generated by the computing device. Based upon the input or feedback, the computing device can be configured to modify the world used to transform the data, modify the output, and/or to determine that the world or the output is not to be modified. The computing device also can be configured to store the preferences for future use and/or for application to other data.

The preferences stored by the computing device can include preferences not only for a particular user, but additionally or alternatively for multiple or all users. Additionally, or alternatively, the preferences can relate to the specific content or output, as well as the user or users. Thus, the preferences also can indicate, for example, that a particular data element, cluster of data elements, presentation aspect, presentation or design scheme, rule, or the like, is more or less important than other data elements, clusters of data elements, presentation aspects, presentation or design schemes, rules, or the like.

While the subject matter described herein is presented in the general context of program modules that execute in conjunction with the execution of an operating system and application programs on a computer system, those skilled in the art will recognize that other implementations may be performed in combination with other types of program modules. Generally, program modules include routines, programs, components, data structures, and other types of structures that perform particular tasks or implement particular abstract data types. Moreover, those skilled in the art will appreciate that the subject matter described herein may be practiced with other computer system configurations, including hand-held devices, multiprocessor systems, microprocessor-based or programmable consumer electronics, minicomputers, mainframe computers, and the like.

In the following detailed description, references are made to the accompanying drawings that form a part hereof, and in which are shown by way of illustration specific embodiments or examples. Referring now to the drawings, in which like numerals represent like elements throughout the several figures, aspects of a computing system, computer-readable storage medium, and computer-implemented methodology for creating variations when transforming data into consumable content will be presented.

Referring now to FIG. **1**, aspects of one operating environment **100** for the various embodiments presented herein will be described. The operating environment **100** shown in FIG. **1** includes a computing device **102**. According to various embodiments, the functionality of the computing device **102** can be provided by a personal computer ("PC") such as a desktop, tablet, or laptop computer system. The functionality of the computing device **102** also can be provided by other types of computing systems including, but not limited to, server computers, handheld computers, netbook computers, embedded computer systems, personal digital assistants, mobile telephones, tablet or slate computers, smart phones, or other devices or systems capable of executing the various software elements described herein in detail. For purposes of describing the concepts and technologies disclosed herein, the computing device **102** is described herein as including a PC or a mobile computing device such as a tablet computer. It should be understood that this embodiment is illustrative, and should not be construed as being limiting in any way.

According to some embodiments, the computing device **102** is configured to operate in communication with, or as part of, a communications network ("network") **104**. In some other embodiments, the computing device **102** does not operate in communication with the network **104**. The computing device **102** can be configured to execute an operating system **106** and one or more application programs, modules, soft-

ware elements, or other computer-executable or computer readable instructions such as, for example, a transformation engine **108**.

The operating system **106** is a computer program for controlling the operation of the computing device **102**. The transformation engine **108** can include an executable program configured to execute on top of the operating system **106** to provide the functionality described herein for creating variations when transforming information into consumable content. Although the transformation engine **108** is illustrated as a component of the computing device **102**, it should be understood that the transformation engine **108** may be embodied as or in a stand-alone device or components thereof operating as part of or in communication with the network **104** and/or the computing device **102**. The transformation engine **108** also can be a virtualized service or technology layer that executes on the computing device **102** and/or on other real or virtual devices. Thus, the illustrated embodiment is illustrative, and should not be construed as being limiting in any way.

As will be explained in more detail below, particularly with reference to FIGS. **2-5**, the transformation engine **108** can be configured to obtain data **110**, to analyze the data **110** to determine a "world" into which the data **110** is to be loaded, to create variations in the content within the world, and/or to transform the data **110** into consumable content that can include, or can be included within, output **112** generated by the computing device **102**. As used herein, the term "world" can be used to refer to an approach for displaying data elements, rules for converting elements in the data **110** to elements in the output **112**, and/or various parameters for introducing or accenting variations within a particular world. Similarly, the term "consumable" as used herein can be used to refer to output such as the output **112** that can be readily or easily viewed, interpreted, or accessed by a user or viewer. More particularly, as explained in more detail below, the output **112** can include various data elements or portions of the data **110** that are arranged by the transformation engine **108** in accordance with the various concepts and technologies disclosed herein. As such, it can be appreciated that the data **110** can include a number of data elements or other portions of data.

In some embodiments, the transformation engine **108** is configured to analyze the data **110** to identify relationships between various data elements within the data **110** and to translate or arrange the data **110** into a relationship-based design based upon a determined world. This relationship-based design can be, but is not necessarily, arranged in a logical and/or hierarchical fashion and/or can be arranged in accordance with various designer-based presentation rules for arranging and/or laying out data. Thus, the phrase "consumable content" can, but does not necessarily, refer to visually appealing and/or logically arranged data. It should be understood, however, that the output **112** as described herein need not be visually appealing and/or that visual appeal can be subjective. For example, the purpose of the output **112** may be utilitarian, such as to present the output **112** that optimizes for readability and/or comprehension. As such, the output **112** can include various data elements or other portions of the data **110** translated into the output **112** as described herein.

According to various embodiments, the computing device **102** is configured to receive or store the data **110**. For example, the data **110** can be stored at the computing device **102** in a memory, disk drive, or other data storage elements. In some other embodiments such as the embodiment illustrated in FIG. **1**, the data **110** can be obtained from a data source **114** that can be configured to operate as part of or in communication with the network **104**. The functionality of the data source **114** can be provided by a network drive, a server computer operating on or in communication with the network **104**, a database or another real or virtual data storage element, and/or other data storage devices. In some embodiments, wherein the transformation engine **108** operates a technology layer within the computing device **102**, the data **110** can be obtained from an application or storage device and loaded into or otherwise provided to the transformation engine **108**. As such, it should be understood that the illustrated and described embodiments of the operating environment **100** are illustrative, and should not be construed as being limiting in any way.

According to various aspects of the concepts and technologies disclosed herein, the transformation engine **108** can include one or more applications, programs, software, computer executable instructions, and/or other data. Some examples of data that can be included as part of the transformation engine **108** are illustrated and described in more detail below with reference to FIG. **2**. Briefly, the computer-executable instructions can include, but are not limited to, instructions for decomposing and understanding content included with the data **110**, instructions for generating and/or suggesting variations to be employed when presenting the data **110** as part of the output **112**, instructions for choosing a theme, mood, color scheme, animations, layout, logical approach, and/or other aspects of a world to be employed in generating the output **112**, rules for tailoring a selected or chosen world, and/or instructions for modifying output based upon input from users or other entities.

These and other aspects of the transformation engine **108** can be provided by a single or multiple applications or modules. Thus, the computing device **102** can, by execution of the transformation engine **108**, receive the data **110**; identify relationships between various elements or other portions of the data **110**; identify, based upon the relationships, a world into which to load the data **110**; determine how the data **110** is to be presented by modifying parameters and/or rules associated with the world; generate the output **112** for presenting the data in the determined formats, schemes, themes, or the like; and present the output **112**. Before, during, or after presentation of the output **112**, the computing device **102** also can be configured to obtain input or feedback ("feedback") regarding the output **112** from users or other entities. In some embodiments, the computing device **102** can be configured to prompt users for the feedback. In some other embodiments, the computing device **102** can be configured to receive the feedback from various users or other entities without prompting for the feedback.

Based upon the feedback received by the computing device **102**, the computing device **102** can select a new world, modify parameters associated with the world, introduce or modify variations added to the data **110**, and/or modify the output **112** to reflect preferences, likes, dislikes, or the like associated with the user or other entity. In some embodiments, the computing device **102** also can be configured to support an "expert mode" in which specific aspects of the output **112** can be adjusted by a user. In some other embodiments, users may be restricted from overriding some or all aspects of the output **112**. As such, the computing device **102** can be configured not only to present the data **110** in a format that is determined by the computing device **102**, but furthermore in a format that is tailored by and/or modified by the user or other entity via providing feedback. It should be understood that this embodiment is illustrative, and should not be construed as being limiting in any way.

In some embodiments, the computing device **102** retrieves, receives, or otherwise obtains the data **110**. The data **110** can

be obtained from a local data storage device or from a remote data storage device or entity such as the data source **114**. The data **110** can include almost any type of information including, but not limited to, documents, text, images, presentations, spreadsheets, web pages, video, media, or other information. Because the data **110** can include other types of information or content, it should be understood that these embodiments are illustrative, and should not be construed as being limiting in any way.

The computing device **102** can be configured to analyze the data **110** to identify a hierarchy and/or relationships within the data **110**. In particular, the computing device **102** can be configured to identify relationships between one or more data elements or portions of data that are included within the data **110**. For example, if the data **110** includes a presentation document, the data elements can include slides of the presentation, objects within slides of the presentation, and/or other portions of data included in the presentation such as individual text characters, images, sentences, words, bullet lists, numbered lists, text blocks, backgrounds, title blocks, media objects, or the like. The computing device **102** can be configured to analyze the various elements or portions ("data elements") of the data **110** to identify relationships between the various data elements and/or to identify a hierarchy within the data **110**. Similarly, the computing device **102** can be configured to recognize relationships between one or more instances of data **110** and/or to receive notifications indicating that the data **110** has changed. For example, images from a FLICKR or other photo album software can be associated with status updates or messages such as FACEBOOK or TWITTER updates and/or timestamp information to identify relationships between the images. As such, even after generating the output **112**, the computing device **102** can be configured to receive an updated version of the data **110** and/or an indication that the data **110** has been updated, and can update the output **112** to reflect the change. Because other types of data and/or data sources can be used to identify relationships between elements of the data **110**, these examples should be understood as being illustrative, and should not be construed as being limiting in any way.

The computing device **102** also can be configured to determine a visualization model to be used for generating the output **112**. In particular, the computing device **102** can determine variations that can be included when generating the output **112** to provide differentiated output **112**. For example, the computing device **102** can apply variations in animations, image sizes, text effects, layouts, color schemes, themes, or other visualizations to the data included as the output **112** to provide highly differentiated output. Furthermore, relationships in the data, such as emphasis, de-emphasis, ordered lists, collections, parent-child relationships, or the like, can be used to create many visualizations, each of which express the underlying relationship. For example, emphasis in text can be visualized by making the text bold, by increasing the font size of the text, by changing the color of the text to red, by adding a subtle animation, and/or in other ways. Thus, a user of the computing device **102** can generate a unique product using the computing device **102** even if other users provide substantially similar or even identical input. In some embodiments, these variations can be added to the output **112** by adjusting various parameters associated with the selected world. It should be understood that this embodiment is illustrative, and should not be construed as being limiting in any way.

The computing device **102** also can be configured to choose a world that is to be used for generating the output **112**. As mentioned above, the term "world" as used herein can be used to refer to a type or category of visualizations and/or themes that can be applied to the data **110** and used to generate the output **112**. The worlds can include instructions for visualizing the data **110** in two-dimensional ("2D") or three-dimensional ("3D") visualizations; specifying fonts and font formats; images and image formats; animations; backgrounds; audio effects; text block sizes and layouts; document layouts; or other aspects of the output **112**. It should be understood, however, that the "worlds" are not necessarily limited to templates. Rather, in the embodiments described herein, the worlds are not templates and instead define facets or aspects of visualizations that can be applied to the data **110** to obtain the output **112** as described herein. For example, in some embodiments a "world" includes a conglomeration of visualizations, styles, and tuned rules that guide how the data **110** is to be handled and displayed. Additional aspects of the worlds disclosed herein are described in additional detail below with reference to FIG. **2**.

Some or all of the worlds also can be associated with a set of rules. Additional aspects of the rules are described in detail below with reference to FIG. **2**. Briefly, the rules can define how the various aspects of the worlds are to be applied to data such as the data **110**. Some additional aspects of the rules and some examples of how the rules can be used are set forth below in more detail with reference to FIG. **2**. The computing device **102** can be configured to obtain rules associated with a chosen world, if available, and to apply those rules to the data **110** to obtain the output **112**. The computing device **102** can thus generate the output **112** and present the output **112** to a user or other entity. The output **112** also can be saved to data storage device, if desired.

As will be explained in more detail below, particularly with reference to FIG. **5**, the computing device **102** and/or the transformation engine **108** executing thereon, can be configured to update the output **112** if the data **110** changes. For example, the computing device **102** can evaluate the world chosen to represent the previous version of the data **110**, adopt a new world, if appropriate, based upon the update, or merely update the output **112** to reflect the modified version of the data **110**. Updating the output **112** can include, but is not limited to, again laying out some or all of the data in the world to accommodate the updates to the data **110**. Animations can be generated for adding the new data, if desired. For example, elements in the output **112** can be moved to make room to accommodate the new data elements. The computing device **102** also can be configured to support a user request to explicitly adopt a different world, to present output **112** generated with multiple worlds to enable a user choice of a preferred world, or the like.

According to some embodiments of the concepts and technologies disclosed herein, the computing device **102** also is configured to obtain and apply user feedback to the output **112**. In some embodiments, the user feedback includes user responses to various prompts or questions. For example, the computing device **102** can present questions to a user or other entity for evaluating various aspects of the output **112**. In some embodiments, the computing device **102** asks or prompts a user or other entity for feedback regarding colors, color schemes, fonts, layouts, element locations, image sizes, importance, emphasis, arrangement of data, or other aspects of the output **112** by expressing whether that particular aspect is liked or disliked.

The computing device **102** also can be configured to generate questions for the user about the various aspects of the output **112** in addition to, or instead to, prompting for feedback. For example, the computing device can ask if a particular aspect is liked or disliked, is good or bad, or the like. It should be understood that the feedback, questions, prompts,

or the like can be formatted as questions with binary yes/no, like/dislike, or true/false answers. The questions or prompts also can request rankings over various ranges such as, for example, scales of numbers such as one to ten, letter grades such as "A" through "F," numbers of stars, or the like. The user can provide this and/or other types of feedback with respect to the entirety of the output **112** and/or the computing device **102** can be configured to ask the user to express this feedback regarding individual parts or components of the output **112**. For example, the computing device **102** can be configured to ask if the output **112** is liked or disliked, or to ask if a particular font, color scheme, and/or other aspect or component of the output **112** is liked or disliked. It should be understood that these embodiments are illustrative, and should not be construed as being limiting in any way.

The computing device **102** can be configured to evaluate the feedback from the user and to determine if the output **112** is to be modified based upon the feedback. For example, if feedback received from the user or another entity indicates that a color scheme is "disliked," the computing device **102** can change the color scheme. Similarly, "likes" can be used to modify the output **112** so aspects of the output **112** that are liked by the user or other entity can be repeated in the output **112** and/or can be used for generating other output **112** in the future. As such, it can be appreciated that various aspects of the output **112** can be modified based upon the feedback. Because the preferences can be fed back into the rules system, the preferences expressed with regard to any particular instance of output **112** can have a consistent effect across the world, instead of, or in addition to, merely updating the current output **112** and/or viewed elements thereof.

In some embodiments, the feedback also can be used to modify a world chosen to represent the data **110** and/or to adjust various parameters or properties associated with the world. Thus, feedback can be used to determine how data **110** is represented in a selected world and/or how various variations are applied within the selected world. It should be understood that these embodiments are illustrative, and should not be construed as being limiting in any way.

FIG. **1** illustrates one computing device **102**, one network **104**, and one data source **114**. It should be understood, however, that some implementations of the operating environment **100** include multiple computing devices **102**, multiple networks **104**, zero or multiple data sources **114** and/or additional or alternative hardware elements. Thus, the illustrated embodiments should be understood as being illustrative, and should not be construed as being limiting in any way.

Turning now to FIG. **2**, additional aspects of the transformation engine **108** will be described in detail, according to an illustrative embodiment. As explained above with reference to FIG. **1**, the transformation engine **108** can be configured to transform the data **110** into the output **112**. In some embodiments, such as the embodiment illustrated in FIG. **2**, the transformation engine **108** includes a number of modules, applications, programs, software, or other computer-executable instructions for providing the functionality described herein with respect to the transformation engine **108** and/or the computing device **102**. Additionally, or alternatively, the transformation engine **108** also can include other data as will be described herein in more detail.

In the illustrated embodiment, the transformation engine **108** includes a decomposition and understanding module **200**, a variation module **202**, a world chooser module **204**, rules **206**, an authoring module **208**, worlds **210**, and other data or instructions (not shown). Although not shown in FIG. **2**, the transformation engine **108** also can include a design rules module for authoring, creating, and/or saving the rules **206**. As such, the transformation engine **108** can be configured to transform the data **110** into the output **112** via execution of one or more portions of computer-executable code or instructions. It should be understood that the various functionality described herein with respect to the various modules and other data shown in FIG. **2** can be provided by a single application, module, program, or other software or data, and that as such, the illustrated embodiment is illustrative and should not be construed as being limiting in any way.

The decomposition and understanding module **200** can be configured to analyze the data **110**. As explained above, the analysis of the data **110** can be completed to understand relationships between the various data elements or other portions of the data **110**. More particularly, in some embodiments the data **110** is arranged in a flow-based format and/or is not arranged in any particular format. The decomposition and understanding module **200** can apply various rules for interpreting the data **110** to identify relationships between the various data. For example, if multiple pages of a presentation or other document include a similar or identical title, the decomposition and understanding module **200** can be configured to determine that the multiple pages are related to one another. Similarly, if a title on one page is similar to a title on the second page but also includes the word "continued" or an abbreviation such as "cont'd," the decomposition and understanding module **200** can determine that these pages are related. It should be understood that these embodiments are illustrative, and should not be construed as being limiting in any way.

In some embodiments, the decomposition and understanding module **200** can be configured to determine that elements in bullet lists or numbered lists are related to one another and/or to a heading of the lists. In some other embodiments, the decomposition and understanding module **200** can be configured to determine that text surrounding the same or similar images is related; that text with similar or identical references or footnotes are related; and/or that other elements or portions of the data **110** are related to one another. In some other embodiments, decomposition and understanding can include image analysis. For example, images can be analyzed to detect faces, salient regions, invariant regions (over which text can be placed), compositional analysis, or other aspects of the image. Various rules for interpreting the data **110** can be applied by the decomposition and understanding module **200**. Because other processes or rules for identifying relationships are contemplated, it should be understood that these embodiments are illustrative, and should not be construed as being limiting in any way.

The variation module **202** can be configured to generate differentiated output **112** for the user or other entity. In particular, the variation module **202** can apply variations in animations, visual effects, designs, themes, or other variations. The variations can be applied to the data **110** to create differentiations that can be used to make each output **112** of the computing device **102** seem unique. These variations can be applied to the data **110**, as described in more detail below with reference to FIG. **3**. In some embodiments, the variations can be introduced to the output **112** via modification or adjustment of one or more properties or parameters associated with a world **210** chosen for representing the data **110**.

The world chooser module **204** can be configured to evaluate and choose a world **210** to apply to the data **110**. As explained above, a "world" can include a theme, model, scheme, or other approach for presenting data that can be stored, selected, and/or applied to data **110** to obtain output **112**. In some embodiments, the worlds are extensible. In

particular, a third party or other entity can create new or additional worlds **210** and can define how the data **110** can be applied to the world **210**.

The world chooser module **204** can be configured to consider various aspects of the data **110** and to determine what visualization models and/or differentiations to apply to the data **110** based upon the determined world **210** that best fits the data **110**. In some embodiments, the world chooser module **204** is configured to determine any worlds **210** that can be used to represent the data **110**. Thus, worlds **210** that are determined to be poor choices for representing the data **110** can be excluded from the group of possible worlds **210**. The world chooser module **204** can rank the possible worlds based upon various considerations, as explained in more detail below with reference to FIG. **4**. Based upon the ranking, the world chooser module **204** can select a world **210** to which to apply the data **110**. In some embodiments, the worlds **210** are stored by the transformation engine **108**, as shown in FIG. **2**. The world chooser module **204** can consider, for example, the shape of the data **110**, hierarchies identified within the data **110**, and other aspects of the data **110**.

As mentioned above, the data **110** can include various data elements **212**. Thus, while various operations and/or analyses are described herein with respect to the data **110**, it should be understood that these and/or other operations can be taken with respect to the data elements **212**. Thus, the world chooser module **204** can, for example, consider relationships between and/or hierarchies among the data elements **212** to rank and select the world **210**. These and other aspects of selecting a world **210** are set forth below in further detail with reference to FIG. **3**.

Additionally, the world chooser module **204** can be configured to determine, at various times, if the world **210** chosen for representing the data **110** should be modified or changed. Thus, for example, the world chooser module **204** can be invoked if the data **110** is updated to determine if the chosen world **210** is to be changed, or if the output **112** is to be changed by applying the modified version of the data **110** to the same world **210**. Additional aspects of updating the world **210** are illustrated and described below with reference to FIG. **5**.

The rules **206** can include adaptive rules that are configured to convert the data **110**, which can include arbitrary content, into the output **112** based upon the variations and the world **210** chosen. In other words, the rules **206** can include categories of translations that can be applied to the data **110** to obtain the output **112**. Thus, in some embodiments the rules **206** include one or more sets of rules for each world **210**, and the rules **206** are selected by the computing device **102** based upon which world **210** is chosen. As such, the rules **206** can be tailored operations, steps, or rules for converting or translating the data **110** into the output **112**. It should be understood that the data **110** may not always be a direct translation into the output **112**. In particular, the content or layout of the data **110** may be manipulated during translation of the data **110** into the output **112**. It should be understood that this embodiment is illustrative, and should not be construed as being limiting in any way.

The rules **206** can be used to select portions of the data **110**, for example the data elements **212** described in more detail below, that are to be included in a layout or other form of the output **112**. In particular, the rules **206** can be used to select the information or data elements **212** for each view in the output **112** and to define what type of information and/or what data elements **212** are needed, desired, or appropriate at any given location within a layout, view, or other output **112** associated with the chosen world. Developers or other entities can specify, by way of the rules **206**, what information is to be presented in each view or layout.

The rules **206** also can be used to determine a flow, progression, and/or layout of the data elements **212** or other information selected for the output **112**. In particular, the computing device **102** can apply the rules **206** to provide decision-making capability when the transformation engine **108** generates layouts associated with the output **112**. The layouts can define what types of information or data elements **212** are used in what grid cells on the screen (or defining location of the data elements **212** using other approaches for placing the data elements **212** on the screen), while the rules **206** can define how the information flows or is modified (stylistically or otherwise, for example the size, shape, or other aspect of the information) once the information is placed in the layout. In some cases, the rules **206** also can handle how the layout is adjusted if information flows beyond the predefined default layout.

The rules **206** also can be applied to the data **110** to upgrade or otherwise modify one or more of the data elements **212** or other information to be included in the output **112**. It therefore can be appreciated that the flow handling behavior of a world for any type of data **110** can be changed by modifying the rules **206** associated with the world. In particular, the rules **206** can be used to improve, upgrade, or otherwise modify data elements **212** or other portions of the data **110**. For example, if a data element **212** includes a low-resolution image, upgrading the data element **212** can include replacing the low-resolution image with an image having a higher resolution, applying image treatments such as blur or the like to the image to create an artistic representation, or the like.

Similarly, if the data element **212** includes a data table, upgrading or improving the data element **212** can include replacing the data table with a graph. These and/or other types of upgrades, improvements, and/or other modifications can be controlled by the rules **206**. Thus, a designer can be given the ability to articulate how specific types of information will be upgraded or otherwise modified using an available set of tools such as upgrading an image, converting to a graph, etc. In some embodiments, the designer can articulate the various rules **206** prior to the application of the rules **206** as described herein. As such, it should be understood that the articulation of the rules **206** can occur at almost any time and that the utilization of the rules **206** can occur at almost any time, including long after the rules **206** have been articulated. It should be understood that these embodiments are illustrative, and should not be construed as being limiting in any way.

The rules **206** also can be applied to the data **110** to score one or more layouts or other forms of the output **112**. In particular, the rules **206** can be used to facilitate selection of a layout by providing feedback regarding how information handled for a given layout and whether a quality bar has been met. Accurate scores for each layout within a world can be obtained and the scores can be adjusted through a set of rules **206** without recompilation of the codebase.

The rules **206** also can be used to score the various worlds **210** considered by the transformation engine **108** and the scores can be passed to the world chooser module **204** for scoring the worlds **210** under consideration. In particular, the rules **206** can be used to facilitate selection of one of the worlds **210** by generating feedback regarding quality of fit of information being placed in the world **210**. The rules **206** may not make a final decision about world ranking, but can be a component that provides information to help make the decision. Accurate scores for each world **210** that describes the fit of the world **210** for the information set can be obtained, and the scores can be adjusted using a set of rules **206** without

recompilation of the codebase. Additional aspects of ranking and selecting worlds **210** are illustrated and described below with reference to FIGS. **4-5**.

According to various implementations of the transformation engine **108**, the rules **206** can be created, modified, and/or deleted by designers, users, or other entities. As such, the rules **206** can be accessible to designers to articulate the rules **206** in a way that fits with the designers' workflow. In some embodiments, tools for allowing the designer to articulate all of the necessary information, ideally in a visual way, to address the prior goals in this list. Additional aspects of the rules **206** are described herein, and as such, the above uses of the rules **206** should be understood as being illustrative and should not be construed as being limiting in any way.

Thus, the rules **206** can be applied to adjust how the data **110** is presented by application of a particular world. For example, the rules **206** can be applied to the data **110** to adjust the readability of text. These adjustments can be based, for example, upon a relative ease with which a typeface can be read when characters are laid out in words, sentences, and paragraphs, upon an assumption that long blocks of text need to be readable to hold the reader and/or to boost comprehension, upon an assumption that setting text in columns can provide short line length, which can improve readability, upon rules that assume that text set with 'ragged right' alignment is more readable than text that is 'force justified' or manipulated to line up on the left and right margins, upon rules for introducing white space, subheads, and/or other elements to divide text to give eyes of a reader resting places to help prevent fatigue, by adjusting leading based on number of lines of text, by adjusting line length based on amount of content and layout, by adjusting the content based upon capabilities of a device used to view the content (e.g., screen size, resolution, input devices, or the like), by adjusting font size based on an amount of content, and/or by applying other adjustments or modifications to the data. It should be understood that this embodiment is illustrative, and should not be construed as being limiting in any way.

The rules **206** also can be used to improve the legibility of the output **112**. For example, the rules **206** can be used to evaluate how easily a particular run of text can be read against background imagery. The rules **206** also can be used to insert transparent fields between background image and text so that text is legible, to overlay semi-transparent backgrounds behind text, so the text is more legible than without the semi-transparent backgrounds, to apply rules for darkening and/or lightening entire images and/or portions thereof, to select font sizes, colors and type styles with superior legibility, to add drop shadow to make text more legible, by repositioning, selecting and/or scaling images to place in regions of a layout such that space for text is left with superior legibility of the text, to add subtle transparency behind text, to apply photo darkening, exposure or other image transformation to modify the image, to apply other adjustments, or the like.

The rules **206** also can be used to improve the quality of the output **112**. For example, the rules **206** can be used to align or constrain text on gridlines and/or adjusting placement or flow of the text so the text visually lines up on the grid, to define text size relationships so that text is optimized for body copy and title copy overlaid on an image, by adjusting leading based on a number of lines of text, by applying text kerning, text leading, baseline alignment of text of various sizes, and the like. The rules **206** also can be used to identify structure in photos so that photos overlaying content relate to the underlying structure in the photo. Similarly, the rules **206** can be used to ensure that text blocks align with one another and/or with other text such that the text blocks flow together to ensure proper placement, alignment, depending on variable strings. Further, structure present in the image itself may either be positioned relative to text in the layout, or may itself guide the placement of text in a given layout. It should be understood that these embodiments are illustrative, and should not be construed as being limiting in any way.

The rules **206** also can be used to adjust images. For example, the rules **206** can be used to provide cropping of images based on one or more salient regions, to upgrade images, to crop and/or avoid cropping images in one or more directions and/or to maintain image orientations. When used to achieve some goal of layout, an image so cropped may include extrapolated and synthesized image data along one or more edges, when governed to be of sufficiently high quality, and when allowable by the world parameters.

The rules **206** also can be used to search for and/or generate a summarization of the data **110**. The rules **206** also can be used to upgrade the data **110** and/or data elements **212**, for example, by using global positioning system ("GPS") or map data to obtain additional information about the places/locations referenced in the data **110**, to add current statistics and/or other types of live content, to add related information such as a number of comments, a number of times the content has been linked to, a number of times the content has been downloaded, or the like. The rules **206** also can be used to size the data **110** and/or data elements **212**. These embodiments are illustrative and should not be construed as being limiting in any way.

The rules **206** also can be used to affect how each data element **212** moves relative to other data elements **212**. For example, some text may react when interacted with and/or hovered over, movement or animation may be affected by speed of movement or what user is interacting with the data **110**, ambient motion can be applied until a click or touch gesture is detected, or the like. These and other movements and/or relative positioning of the data elements **212** can be determined by the rules **206**. The rules **206** also can be used to determine orders of the data elements **212**, how content is navigated to (e.g., a number of clicks, swipes, screens to navigate through, or the like).

As mentioned above, the rules **206** also can be used to create variations in the data elements **212** and/or other portions of the data **110**. The rules **206** can apply some variations based upon what data **110** or data elements **212** surround a particular data portion or data element **212**. The variations also can be based upon the content. For example, if the data **110** corresponds to timeline-based data, the world or layout can be chosen based upon an assumption or recognition that few images are included. It should be understood that this embodiment is illustrative, and should not be construed as being limiting in any way.

The rules **206** also can be used to select, size, and/or otherwise format typefaces and/or other settings associated with text. For example, the rules **206** can be used to select a highlight color and/or complimentary colors for text or fields nearby. The rules **206** also can be used to define a color palette based upon on a source of the content. For example, a color scheme can be selected based upon a color scheme associated with a particular brand, color schemes included in the data **110**, color schemes extracted from included imagery, or the like. Motion also can be varied and/or selected based upon the rules **206**. It should be understood that these embodiments are illustrative, and should not be construed as being limiting in any way.

The authoring module **208** can be configured to analyze feedback **214** regarding the output **112** from a user or other entity. The feedback **214** can be obtained by the authoring

module **208** and/or can be obtained by the transformation engine **108** and passed to the authoring module **208**. The authoring module **208** can be configured to apply the feedback **214** to the output **112** to modify the output **112**. The authoring module **208** also can be configured to store the feedback **214** for future uses of the transformation engine **108**.

Thus, although not shown in FIGS. **1-2**, it should be understood that user preferences can be developed by the transformation engine **108** and can be stored and applied by the transformation engine **108**, if desired. As explained above with regard to modifying output **112** based upon feedback **214**, the authoring module **208** can be configured to prompt for the feedback **214** or can be configured to receive the feedback **214** from a user or other entity. The feedback **214** can be provided in terms of likes or dislikes, as yes/no or true/false answers to questions, as rating information such as numbers of stars, numbers within ranges, letter grades, through extrapolation of simple actions such as selection or reordering, or the like. The feedback **214** can be interpreted by the authoring module **208**.

As noted above, in addition to changing the output **112** based upon dislikes, the authoring module **208** also can be configured to modify the output **112** based upon likes. In particular, the transformation engine **108** can repeat and/or use more often various aspects of the output **112** that are liked by users. It should be understood that a user's likes or dislikes also can be used by the transformation engine **108** for other users. In particular, the transformation engine **108** can be configured to recognize similarities between and/or among various users based upon preferences, based upon social networking information, and/or based upon other information, and that the transformation engine **108** can apply a particular user's preferences to another user who is considered to be or is indicated as being similar to the user. It should be understood that these embodiments are illustrative, and should not be construed as being limiting in any way.

In light of the above description of FIG. **2**, it should be understood that the computing device **102** described herein can provide the functions of the transformation engine **108** and/or the various modules of the transformation engine **108** by execution of any number of applications, software components, modules, or other instructions. As such, when the specification refers to functions of the "computing device," it should be understood that the functionality described can include functionality provided by any of the software modules, data, and/or hardware elements described herein. Furthermore, it should be understood that the transformation engine **108** can operate as a technology layer that is called or accessed by various programs executing at the computing device **102**. Similarly, the transformation engine **108** can be operated as a service that can be called by various applications or devices. As such, the various described embodiments are illustrative and should not be construed as being limiting in any way.

Turning now to FIG. **3**, aspects of a method **300** for transforming data into consumable content will be described in detail. It should be understood that the operations of the methods disclosed herein are not necessarily presented in any particular order and that performance of some or all of the operations in an alternative order(s) is possible and is contemplated. The operations have been presented in the demonstrated order for ease of description and illustration. Operations may be added, omitted, and/or performed simultaneously, without departing from the scope of the appended claims.

It also should be understood that the illustrated methods can be ended at any time and need not be performed in its entirety. Some or all operations of the methods disclosed herein, and/or substantially equivalent operations, can be performed by execution of computer-readable instructions included on a computer-storage media, as defined herein. The term "computer-readable instructions," and variants thereof, as used in the description and claims, is used expansively herein to include routines, applications, application modules, program modules, programs, components, data structures, algorithms, and the like. Computer-readable instructions can be implemented on various system configurations, including single-processor or multiprocessor systems, minicomputers, mainframe computers, personal computers, hand-held computing devices, microprocessor-based, programmable consumer electronics, combinations thereof, and the like.

Thus, it should be appreciated that the logical operations described herein are implemented (1) as a sequence of computer implemented acts or program modules running on a computing system and/or (2) as interconnected machine logic circuits or circuit modules within the computing system. The implementation is a matter of choice dependent on the performance and other requirements of the computing system. Accordingly, the logical operations described herein are referred to variously as states, operations, structural devices, acts, or modules. These operations, structural devices, acts, and modules may be implemented in software, in firmware, in special purpose digital logic, and any combination thereof.

For purposes of illustrating and describing the concepts of the present disclosure, the methods disclosed herein are described as being performed by the computing device **102** via execution of computer executable instructions such as, for example, the transformation engine **108**. As explained above with regard to FIG. **2**, the transformation engine **108** can include various modules and/or other data that can be executed and/or used by the computing device **102** to provide the functionality described herein. It should be understood that additional or alternative devices can provide the functionality described herein via execution of instructions other than, or in addition to, the transformation engine **108**. As such, it should be understood that the described embodiments are illustrative, and should not be viewed as being limiting in any way.

The method **300** begins at operation **302**, wherein the computing device **102** obtains the data **110**. As explained above, the data **110** can include various types of information or content such as, for example, media files including, but not limited to, video files, animation files, slide show files, image files, audio files, other media files, or the like; text documents; plain text; web pages, web content, rich text, or the like; and/or other types of information. In one contemplated embodiment, the data **110** corresponds to a presentation file such as a file generated by a member of the MICROSOFT POWERPOINT family of presentation software products from Microsoft Corporation in Redmond, Wash. In light of the various types of information that can be provided as the data **110**, it should be understood that this embodiment is illustrative, and should not be construed as being limiting in any way.

According to various implementations, the data **110** is obtained from a data storage device or component associated with the computing device **102**. Some examples of data storage devices are described in more detail below with reference to FIGS. **6-8**. In some other embodiments, the data **110** can be stored at a remote storage device or resource such as the data source **114** described herein. Thus, the data **110** can be obtained by the computing device **102** via communications

with the data source **114**. As such, it should be understood that the data **110** can be obtained from any real or virtual device via a direct connection, via one or more networks, and/or via other nodes, devices, and/or device components.

From operation **302**, the method **300** proceeds to operation **304**, wherein the computing device **102** can identify relationships between data elements or other portions of the data **110**. Some types of information, and some embodiments of the data **110**, can be arranged or organized in a flow-based arrangement and/or otherwise may not be arranged in a logical and/or hierarchical arrangement. For example, each slide or page of a document such as a word processing document or a presentation may include data elements **212** such as a title, one or more paragraphs of text, one or more sentences, one or more words, one or more bullet points, one or more numbered lists, one or more tables, one or more images, and/or other objects. In some instances, each slide or page can be directed to or addresses a different topic or sub-topic. In some other instances, each slide or page can be directed to a same or similar topic. Operation **304** can include determining and identifying relationships between the various data elements **212** or other portions of the data **110**. In some embodiments, the computing device **102** provides the functionality described herein with respect to operation **304** via execution of the decomposition and understanding module **200**. It should be understood that this embodiment is illustrative, and should not be construed as being limiting in any way.

In one contemplated example, a ten-page document can include a title on each page. The title can be indicated by a block or field that is labeled "title" and/or can be determined to include a title based upon the location, formatting, size, color, contents, or other aspect of the information. Thus, if three of the ten pages include the same or similar title information, the three pages can be considered to be related and information on the three pages can be determined to share a relationship to the title. In another example, the computing device **102** can be configured to consider a numbered list or bulleted list under a heading as being related to the heading. Similarly, the computing device **102** can be configured to consider numbered or bulleted items within the lists as being related to one another.

Thus, it can be appreciated that the location, size, format, content, and/or other aspects of text, images, or other data, as well as relative position, location, format, size, contents, or other aspects of the data, relative to other data in the documents, can be used to determine relationships between the data in operation **304**. Because many other approaches for identifying relationships between various data elements or other portions of the data **110** are contemplated, it should be understood that these embodiments are illustrative, and should not be construed as being limiting in any way.

From operation **304**, the method **300** proceeds to operation **306**, wherein the computing device **102** determines variations to apply to the data **110**. In operation **306**, the computing device **102** can examine the relationships determined in operation **304** to determine how the data **110** is to be presented. In particular, the computing device **102** can examine various factors associated with the data **110** and determine how to add variations to the data **110**. Thus, for example, the computing device **102** can determine visual effects, designs, and/or other variations that can be applied to the data **110** to present the relationships determined in operation **304** in various ways. In one contemplated embodiment, the computing device **102** provides the functionality described herein with respect to operation **306** via execution of the variation module **202** illustrated and described in more detail above with reference to FIG. **2**. It should be understood that this embodiment is illustrative, and should not be construed as being limiting in any way.

From operation **306**, the method **300** proceeds to operation **308**, wherein the computing device **102** chooses a world **210** for presenting the data **110**. Additional aspects of selecting a world **210** are illustrated and described below with reference to FIG. **4**. Briefly, as mentioned above, the term "world" as used herein can include a type of visualization and/or theme that can be applied to the data **110** and used to generate the output **112**. In operation **308**, the computing device **102** can select a world **210** based upon the various aspects of the data **110**, the variations identified in operation **306**, relationships between the data elements **212**, and/or based upon other considerations. For example, the computing device **102** can be configured to examine a shape of the data **110** such as, for example, an overall mood or tone of the data **110**; a length of the data **110** such as a presentation or document; a text to image ratio of the data **110**; a number of images or other media objects in the data **110**; a total number of text characters, words, sentences, paragraphs, or the like in the data **110**; an expected audience of the output **112**; an expected venue for viewing the output **112**; an expected display medium such as a display device expected to be used to view the output **112**; a location at which the output **112** may be viewed; hierarchies within the data **110** and/or among data elements **212**; input mechanisms that may be used when viewing or interacting with the output **112**; relative sizes of the visual objects or other data elements **212** such as text, images, or the like; and/or other aspects of the data **110**.

In selecting a world **210**, the computing device **102** can consider a number of worlds **210** or can identify a single world **210** that fits the data **110** and/or the determined relationships, hierarchies, mood, shape, and/or other aspects of the data **110** and/or the data elements **212**. Thus, operation **308** can include selecting a highest-ranked world **210** from a number of available worlds **210**, identifying a single world **210** based upon the variations, or receiving input specifying a particular world **210**. In one contemplated embodiment, the computing device **102** provides the functionality described herein with respect to operation **308** via execution of the world chooser module **208**. It should be understood that this embodiment is illustrative, and should not be construed as being limiting in any way.

From operation **308**, the method **300** proceeds to operation **310**, wherein the computer device **102** obtains rules **206** associated with the chosen world **210**. In operation **310**, the computing device **102** can apply the rules **206** associated with the selected world **210** to the data **110**. Via application of the rules **206** to the data **110**, the computing device **102** can be configured to present the data **110** in a designed way. In particular, the rules **206** can specify how data **110** is to be presented in a particular world **210**. Thus, operation **310** can include obtaining the rules **206** based, at least partially, upon the world **210** chosen in operation **308**.

From operation **310**, the method **300** proceeds to operation **312**, wherein the computer device **102** applies the rules **206** obtained in operation **310**. As mentioned above, the computing device **102** can apply the rules **206** to the data **110** to format the data **110** in a format or form associated with the world **210** chosen in operation **308**. For example, a rule **206** can define a font in which text is to be presented, a size for displayed images, or other instructions for modifying the data **110** to obtain the output **112**. It should be understood that this embodiment is illustrative, and should not be construed as being limiting in any way.

From operation **312**, the method **300** proceeds to operation **314**, wherein the computer device **102** generates the output **112**. In operation **314**, the computing device **102** can apply the variations, world **210**, and rules **206** identified in operations **306-312** to the data **110**. From operation **314**, the method **300** proceeds to operation **316**, wherein the computer device **102** presents the output **112**. The output **112** can be presented, for example, on a display device associated with the computing device **102** and/or another device. In some embodiments, the computing device **102** can be configured to save the output **112** to a data storage device for later viewing or presentation, although such an operation is not shown in FIG. **3**. For purposes of describing the various embodiments of the concepts and technologies disclosed herein, the method **300** is described with respect to an embodiment in which the output **112** is displayed on a display device associated with the computing device **102**. It should be understood that this embodiment is illustrative, and should not be construed as being limiting in any way.

From operation **316**, the method **300** proceeds to operation **318**, wherein the computer device **102** determines if the data or relationships used to generate the output **112** are to be modified based upon feedback **214** received at the computing device **102**. Thus, while not shown in FIG. **3**, the method **300** can include an operation for receiving feedback **214** at the computing device **102** and/or for prompting a user or other entity for feedback regarding the output **112**. In some embodiments, for example, the output **112** is presented and a user is prompted for feedback **214** regarding the output **112**. For example, a user may be asked if the output **112** is visually appealing, if a particular color is liked or disliked, if the layout of the elements is liked or disliked, and/or other questions. In some embodiments, the computing device **102** receives feedback **214** and/or comments regarding almost any aspect of the output **112**.

In response to the feedback **214** received at the computing device **102**, the computing device **102** can determine that the data or relationships used to generate the output **112** are to be modified. For example, the computing device **102** can determine that a color, a layout, a color scheme, a theme, a mood, or other aspect of the output **112** is to be modified in response to the feedback **214**, and can determine, based upon this determination, that a data element or a relationship used to generate that aspect of the output **112** is to be modified. It should be understood that in determining that the data or relationships used to generate output **112** are to be modified, the computing device **102** can determine that the data **110** and/or the relationships or hierarchies determined in operation **304**, as well as the world **210** chosen in operation **308**, may be changed, among other aspects of the output **112**. Because almost any aspect of the output **112** can be changed, it should be understood that these embodiments are illustrative, and should not be construed as being limiting in any way.

If the computing device **102** determines, in operation **318**, that the output **112** is to be modified, the method **300** proceeds to operation **320**, wherein the computing device **102** modifies the data or relationships used to generate the output **112**. The modifications to the data or relationships can include emphasizing or de-emphasizing text, resizing text, resizing images, changing formats of text or images, changing text fonts, sizes, or colors, changing worlds **210**, changing visualization modes, changing variations or types of variations, and/or otherwise modifying the data or relationships used to generate the output **112**. Because additional or alternative modifications can be made to data or relationships used to generate the output **112**, it should be understood that these embodiments are illustrative, and should not be construed as being limiting in any way.

From operation **320**, the method returns to operation **312**, wherein the rules **206** are again applied to the data **110**. A such, it can be appreciated that operations **312-320** of the method **300** can be repeated until, in any iteration of operation **318**, the computing device **102** determines that the data or relationships used to generate the output **112** are not to be modified. If the computing device **102** determines that the data or relationships used to generate the output **112** are not to be modified, the method **300** proceeds to operation **322**. The method **300** ends at operation **322**.

Turning now to FIG. **4**, additional aspects of choosing a world **210** will be described in detail. In particular, FIG. **4** illustrates aspects of a method **400** for ranking and selecting a world **210** for introducing variations to the data **110**, according to some illustrative embodiments. It should be understood that the method **400** illustrated in FIG. **4** can, but is not necessarily, executed by the computing device **102** in operation **308** of the method **300** illustrated in FIG. **3**. As such, the illustrated embodiment should be understood as being illustrative and should not be construed as being limiting in any way.

The method **400** begins at operation **402**, wherein the computing device **102** identifies possible worlds **210** for the data **110**. As mentioned above, the computing device **102** can be configured to examine a shape of the data **110** such as, for example, an overall mood or tone of the data **110**; a length of the data **110** such as a presentation or document; a text to image ratio of the data **110**; a number of images or other media objects in the data **110**; a total number of text characters, words, sentences, paragraphs, or the like in the data **110**; types of images included in the data **110** such as, for example, high resolution images, low resolution images, images with faces, or the like; an expected audience of the output **112**; an expected venue for viewing the output **112**; an expected display medium such as a display device expected to be used to view the output **112**; a location at which the output **112** may be viewed; hierarchies within the data **110** and/or among data elements **212**; input mechanisms that may be used when viewing or interacting with the output **112**; relative sizes of the visual objects or other data elements **212** such as text, images, or the like; and/or other aspects of the data **110**. Thus, the computing device **102** can analyze the data **110** to compile a list of properties that describe a type of data **110** that is obtained by the computing device **102**.

Based, at least partially, upon the shape of data **110**, the computing device **102** can determine worlds **210** that can be used to represent the data **110**. In some embodiments, the computing device **102** can exclude worlds **210** that are determined by the computing device **102** to be poor or inappropriate for the type of data **110** being analyzed. For example, if the data **110** includes large blocks of text and a few low resolution images, a world **210** designed for presentation of multiple high resolution images with little text may be determined by the computing device **102** to be poor choices for representation of the data **110**. Thresholds can be defined for determining possible worlds **210**. For example, the computing device **102** can be configured to ignore or exclude worlds **210** determined to be less appropriate than a defined threshold. The threshold can be applied to appropriateness based upon a text to image ratio, number of text characters to space of text ratios, other ratios, other non-ratio considerations, and/or the like. As such, the list of possible worlds **210** compiled in operation **402** can include zero worlds **210**, one world **210**, and/or more than one world **210**.

From operation **402**, the method **400** proceeds to operation **404**, wherein the computing device **102** ranks the possible worlds **210**. In some embodiments, the computing device **102** can determine an appropriateness level or factor relating the world **210** to the data **110**. This appropriateness factor can be based upon the determined shape of the data **110** and how the world **210** is or is not appropriate for the determined shape based upon one or more rules. The various aspects of each of the possible worlds **210** can be determined, based upon the data **110** and/or the identified relationships, and each world **210** can be ranked.

For example, a particular world **210** may be determined to be appropriate for data **110** having a text to image ratio of 2:1 or higher and an average sentence length of fifteen words or lower. If the data **110** has an text to image ratio of 1.8:1 and an average sentence length of eighteen words, the world **210** may be determined. Another world **210** determined to be appropriate for data **110** having an image ratio of 1.5:1 or higher and an average sentence length of twenty words or lower, meanwhile, may be ranked higher than the first example world **210** discussed above. Because many other aspects of data shape can be considered in weighting and/or ranking worlds **210**, this example should be understood as being illustrative and should not be construed as being limiting in any way.

From operation **404**, the method **400** can proceed to operation **406**, wherein the computing device **102** can select a world **210** based upon the ranking In some embodiments, the highest ranked world **210** can be chosen. In some embodiments, if multiple worlds **210** are ranked identically or substantially similarly, a user can select a world **210**, the world **210** can be chosen randomly from the worlds **210** having a same or similar ranking, or other considerations can prompt selection of the highest ranked world **210**.

From operation **406**, the method **400** proceeds to operation **408**, wherein the computing device **102** outputs the selected world **210** and/or data indicating the world **210** selected by the computing device **102**. As such, the computing device **102** can generate data indicating what world **210** is to be used to transform the data **110** into the output **112**.

From operation **408**, the method **400** proceeds to operation **410**. The method can end at operation **410**. In some embodiments, wherein the functionality described herein with reference to FIG. **4** is executed by the computing device **102** in association with operation **308** of the method **300**, the computing device **102** can resume execution of the method **300** at operation **310** after executing the method **400**. Because the method **400** may or may not be associated with execution of the method **300**, it should be understood that this embodiment is illustrative, and should not be construed as being limiting in any way.

FIG. **5** illustrates aspects of a method **400** for changing a world **210** for introducing variations to the data **110**, according to some illustrative embodiments. It should be understood that the illustrated embodiment of the method **400** is illustrative and should not be construed as being limiting in any way. The method **500** begins at operation **502**, wherein the computing device **102** determines if new content is detected. In particular, the computing device **102** can determine if a new version of the data **110** has been released, detected, or received; if a new data element **212** has been released, detected, or received; and/or if a notification indicating new data **110** and/or a new data element **212** has been received or detected.

In some embodiments, the data **110** can include or can correspond to a data feed such as an RSS feed; a comments section of a weblog, article, social networking post, website, or the like; a realtime message feed such as a messaging feed provided by the TWITTER realtime messaging service; a photo album or photo feed; or other data **110** that may change over time. As such, the computing device **102** can subscribe to the feed to obtain or detect updates, or can receive notifications from other devices that data has changed. It should be understood that these embodiments are illustrative, and should not be construed as being limiting in any way.

If the computing device **102** determines that the data **110** has not changed, the method **500** can return to operation **502**, wherein the computing device **102** can again determine if the data **110** has changed. Thus, execution of the method **500** can pause at operation **502** until a data update is detected. If the computing device **102** determines, in any iteration of operation **502**, that the data **110** has changed, the method **500** proceeds to operation **504**.

In operation **504**, the computing device **102** can determine if the world **210** is to be changed. In some embodiments, the functionality of operation **502** can be omitted, and the method **500** can begin with the functionality described herein with respect to operation **504**. As such, it should be understood that in some embodiments the indication that a world **210** is to be changed can come from an explicit command from a user or other entity to change the world **210** used to represent the data **110**.

In some other embodiments, the computing device **102** can, upon detecting a change to the data **110**, examine the world **210** and determine if the change made to the data **110** indicates that the chosen world **210** is to be changed. The determination that the world **210** is to be changed can be made based upon any number of considerations such as, for example, an indication of a maximum number of elements that can be represented with a particular world **210**, a change in data types, a change in update frequency, or the like. Because other approaches for determining if a world **210** is to be changed are contemplated and are possible, it should be understood that these embodiments for making such a determination are illustrative, and should not be construed as being limiting in any way.

If the computing device **102** determines, in operation **504**, that the world **210** is not to be changed, the method **500** can return to operation **502**, wherein the computing device **102** can again determine if the data **110** has changed. Although not explicitly illustrated in FIG. **5**, the rules **206** can be re-evaluated and/or the world **510** can be changed to accommodate the changes in the data **110**. Thus, execution of the method **500** can repeat operations **502-504** until the computing device **102** determines, in any iteration of operation **504**, that a world **210** is to be changed. If the computing device **102** determines, in any iteration of operation **504**, that the world **210** is to be changed, the method **500** proceeds to operation **506**.

At operation **506**, the computing device **102** can rank possible worlds **210** for presenting the data **110**. Thus, although not shown in FIG. **5**, the computing device **102** can again identify all possible worlds **210**, and can rank the possible worlds **210** based upon the new or updated data **110**. It should be understood that the functionality of the computing device for a ranking possible worlds **210** can be, but is not necessarily, similar or even identical to the ranking of possible worlds **210** as illustrated in FIG. **4**.

From operation **506**, the method **500** proceeds to operation **508**, wherein the computing device **102** selects a world **210** based upon the ranking. From operation **508**, the method **500** proceeds to operation **510**, wherein the computing device **102** outputs the selected world **210**. It should be understood that the functionality of the computing device for selecting the world **210** and outputting the selected world **210** as shown in

operations **508-510** can be, but are not necessarily, similar or even identical to the ranking and selecting of a world **210** as illustrated and described above with reference to operations **406-408** of FIG. **4**. From operation **510**, the method **500** proceeds to operation **512**. The method can end at operation **512**.

As mentioned above, but not illustrated explicitly in FIG. **5**, the world **210** can be changed based upon feedback **214**. Thus, for example, user likes and/or dislikes can be used to determine that new world **210** is to be selected for representing the data **110**. Additionally, or alternatively, a user can specify that the data **110** is to be loaded into a new world **210** explicitly. Thus, the computing device **102** can be configured to present representations of the data **110** loaded into multiple world **210**, and a user or other entity can select a desired world **210** based upon the representations. Because other methods for changing the world based upon feedback **214** and/or other input are contemplated and are possible, it should be understood that these embodiments of input are illustrative, and should not be construed as being limiting in any way.

FIG. **6** illustrates an illustrative computer architecture **600** for a device capable of executing the software components described herein for creating variations when transforming data into consumable content. Thus, the computer architecture **600** illustrated in FIG. **6** illustrates an architecture for a server computer, mobile phone, a PDA, a smart phone, a desktop computer, a netbook computer, a tablet computer, and/or a laptop computer. The computer architecture **600** may be utilized to execute any aspects of the software components presented herein.

The computer architecture **600** illustrated in FIG. **6** includes a central processing unit **602** ("CPU"), a system memory **604**, including a random access memory **606** ("RAM") and a read-only memory ("ROM") **608**, and a system bus **610** that couples the memory **604** to the CPU **602**. A basic input/output system containing the basic routines that help to transfer information between elements within the computer architecture **600**, such as during startup, is stored in the ROM **608**. The computer architecture **600** further includes a mass storage device **612** for storing the operating system **106** and one or more application programs including, but not limited to, the transformation engine **108**. Although not shown in FIG. **6**, the mass storage device **612** also can be configured to store the data **110**, the output **112**, the rules **206**, the worlds **210**, the data elements **212**, the feedback **214**, and/or other applications, modules, or other information described herein.

The mass storage device **612** is connected to the CPU **602** through a mass storage controller (not shown) connected to the bus **610**. The mass storage device **612** and its associated computer-readable media provide non-volatile storage for the computer architecture **600**. Although the description of computer-readable media contained herein refers to a mass storage device, such as a hard disk or CD-ROM drive, it should be appreciated by those skilled in the art that computer-readable media can be any available computer storage media or communication media that can be accessed by the computer architecture **600**.

Communication media includes computer readable instructions, data structures, program modules, or other data in a modulated data signal such as a carrier wave or other transport mechanism and includes any delivery media. The term "modulated data signal" means a signal that has one or more of its characteristics changed or set in a manner as to encode information in the signal. By way of example, and not limitation, communication media includes wired media such as a wired network or direct-wired connection, and wireless media such as acoustic, RF, infrared and other wireless media. Combinations of the any of the above should also be included within the scope of computer-readable media.

By way of example, and not limitation, computer storage media may include volatile and non-volatile, removable and non-removable media implemented in any method or technology for storage of information such as computer-readable instructions, data structures, program modules or other data. For example, computer media includes, but is not limited to, RAM, ROM, EPROM, EEPROM, flash memory or other solid state memory technology, CD-ROM, digital versatile disks ("DVD"), HD-DVD, BLU-RAY, or other optical storage, magnetic cassettes, magnetic tape, magnetic disk storage or other magnetic storage devices, or any other medium which can be used to store the desired information and which can be accessed by the computer architecture **600**. For purposes the claims, the phrase "computer storage medium" and variations thereof, does not include waves, signals, and/or other transitory and/or intangible communication media, per se.

According to various embodiments, the computer architecture **600** may operate in a networked environment using logical connections to remote computers through a network such as the network **104**. The computer architecture **600** may connect to the network **104** through a network interface unit **614** connected to the bus **610**. It should be appreciated that the network interface unit **614** also may be utilized to connect to other types of networks and remote computer systems, for example, the data source **114**. The computer architecture **600** also may include an input/output controller **616** for receiving and processing input from a number of other devices, including a keyboard, mouse, or electronic stylus (not shown in FIG. **6**). Similarly, the input/output controller **616** may provide output to a display screen, a printer, or other type of output device (also not shown in FIG. **6**).

It should be appreciated that the software components described herein may, when loaded into the CPU **602** and executed, transform the CPU **602** and the overall computer architecture **600** from a general-purpose computing system into a special-purpose computing system customized to facilitate the functionality presented herein. The CPU **602** may be constructed from any number of transistors or other discrete circuit elements, which may individually or collectively assume any number of states. More specifically, the CPU **602** may operate as a finite-state machine, in response to executable instructions contained within the software modules disclosed herein. These computer-executable instructions may transform the CPU **602** by specifying how the CPU **602** transitions between states, thereby transforming the transistors or other discrete hardware elements constituting the CPU **602**.

Encoding the software modules presented herein also may transform the physical structure of the computer-readable media presented herein. The specific transformation of physical structure may depend on various factors, in different implementations of this description. Examples of such factors may include, but are not limited to, the technology used to implement the computer-readable media, whether the computer-readable media is characterized as primary or secondary storage, and the like. For example, if the computer-readable media is implemented as semiconductor-based memory, the software disclosed herein may be encoded on the computer-readable media by transforming the physical state of the semiconductor memory. For example, the software may transform the state of transistors, capacitors, or other discrete circuit elements constituting the semiconductor memory. The

software also may transform the physical state of such components in order to store data thereupon.

As another example, the computer-readable media disclosed herein may be implemented using magnetic or optical technology. In such implementations, the software presented herein may transform the physical state of magnetic or optical media, when the software is encoded therein. These transformations may include altering the magnetic characteristics of particular locations within given magnetic media. These transformations also may include altering the physical features or characteristics of particular locations within given optical media, to change the optical characteristics of those locations. Other transformations of physical media are possible without departing from the scope and spirit of the present description, with the foregoing examples provided only to facilitate this discussion.

In light of the above, it should be appreciated that many types of physical transformations take place in the computer architecture **600** in order to store and execute the software components presented herein. It also should be appreciated that the computer architecture **600** may include other types of computing devices, including hand-held computers, embedded computer systems, personal digital assistants, and other types of computing devices known to those skilled in the art. It is also contemplated that the computer architecture **600** may not include all of the components shown in FIG. **6**, may include other components that are not explicitly shown in FIG. **6**, or may utilize an architecture completely different than that shown in FIG. **6**.

FIG. **7** illustrates an illustrative distributed computing environment **700** capable of executing the software components described herein for creating variations when transforming data into consumable content. Thus, the distributed computing environment **700** illustrated in FIG. **7** can be used to provide the functionality described herein with respect to the computing device **102**. The distributed computing environment **700** thus may be utilized to execute any aspects of the software components presented herein.

According to various implementations, the distributed computing environment **700** includes a computing environment **702** operating on, in communication with, or as part of the network **704**. The network **704** also can include various access networks. According to various implementations, the functionality of the network **704** is provided by the network **104** illustrated in FIGS. **1** and **6**. One or more client devices **706**A-**706**N (hereinafter referred to collectively and/or generically as "clients **706**") can communicate with the computing environment **702** via the network **704** and/or other connections (not illustrated in FIG. **7**). In the illustrated embodiment, the clients **706** include a computing device **706**A such as a laptop computer, a desktop computer, or other computing device; a slate or tablet computing device ("tablet computing device") **706**B; a mobile computing device **706**C such as a mobile telephone, a smart phone, or other mobile computing device; a server computer **706**D; and/or other devices **706**N. It should be understood that any number of clients **706** can communicate with the computing environment **702**. Two example computing architectures for the clients **706** are illustrated and described herein with reference to FIGS. **6** and **6**. It should be understood that the illustrated clients **706** and computing architectures illustrated and described herein are illustrative, and should not be construed as being limited in any way.

In the illustrated embodiment, the computing environment **702** includes application servers **708**, data storage **710**, and one or more network interfaces **712**. According to various implementations, the functionality of the application servers **708** can be provided by one or more server computers that are executing as part of, or in communication with, the network **704**. The application servers **708** can host various services, virtual machines, portals, and/or other resources. In the illustrated embodiment, the application servers **708** host one or more virtual machines **714** for hosting applications or other functionality. According to various implementations, the virtual machines **714** host one or more applications and/or software modules for providing the functionality described herein for creating variations when transforming data into consumable content. It should be understood that this embodiment is illustrative, and should not be construed as being limiting in any way. The application servers **708** also host or provide access to one or more Web portals, link pages, Web sites, and/or other information ("Web portals") **716**.

According to various implementations, the application servers **708** also include one or more mailbox services **718** and one or more messaging services **720**. The mailbox services **718** can include electronic mail ("email") services. The mailbox services **718** also can include various personal information management ("PIM") services including, but not limited to, calendar services, contact management services, collaboration services, and/or other services. The messaging services **720** can include, but are not limited to, instant messaging services, chat services, forum services, and/or other communication services.

The application servers **708** also can include one or more social networking services **722**. The social networking services **722** can include various social networking services including, but not limited to, services for sharing or posting status updates, instant messages, links, photos, videos, and/or other information; services for commenting or displaying interest in articles, products, blogs, or other resources; and/or other services. In some embodiments, the social networking services **722** are provided by or include the FACEBOOK social networking service, the LINKEDIN professional networking service, the MYSPACE social networking service, the FOURSQUARE geographic networking service, the YAMMER office colleague networking service, and the like. In other embodiments, the social networking services **722** are provided by other services, sites, and/or providers that may or may not explicitly be known as social networking providers. For example, some web sites allow users to interact with one another via email, chat services, and/or other means during various activities and/or contexts such as reading published articles, commenting on goods or services, publishing, collaboration, gaming, and the like. Examples of such services include, but are not limited to, the WINDOWS LIVE service and the XBOX LIVE service from Microsoft Corporation in Redmond, Wash. Other services are possible and are contemplated.

The social networking services **722** also can include commenting, blogging, and/or microblogging services. Examples of such services include, but are not limited to, the YELP commenting service, the KUDZU review service, the OFFICETALK enterprise microblogging service, the TWITTER messaging service, the GOOGLE BUZZ service, and/or other services. It should be appreciated that the above lists of services are not exhaustive and that numerous additional and/or alternative social networking services **722** are not mentioned herein for the sake of brevity. As such, the above embodiments are illustrative, and should not be construed as being limited in any way.

As shown in FIG. **7**, the application servers **708** also can host other services, applications, portals, and/or other resources ("other resources") **724**. It thus can be appreciated that the computing environment **702** can provide integration

of the concepts and technologies disclosed herein provided herein for creating variations when transforming data into consumable content with various mailbox, messaging, social networking, and/or other services or resources. For example, the concepts and technologies disclosed herein can be used to transform social networking data or mailbox data into visual content for a user. Similarly, the concepts and technologies disclosed herein can be used to transform messaging or other resources into visual content. It should be understood that these embodiments are illustrative, and should not be construed as being limiting in any way.

As mentioned above, the computing environment **702** can include the data storage **710**. According to various implementations, the functionality of the data storage **710** is provided by one or more databases operating on, or in communication with, the network **704**. The functionality of the data storage **710** also can be provided by one or more server computers configured to host data for the computing environment **702**. The data storage **710** can include, host, or provide one or more real or virtual datastores **726**A-**726**N (hereinafter referred to collectively and/or generically as "datastores **726**"). The datastores **726** are configured to host data used or created by the application servers **708** and/or other data. Although not illustrated in FIG. **7**, the datastores **726** also can host or store the data **110**, the output **112**, the rules **206**, the worlds **210**, the data elements **212**, the feedback **214**, and/or other data, computer executable instructions, or other information described herein.

The computing environment **702** can communicate with, or be accessed by, the network interfaces **712**. The network interfaces **712** can include various types of network hardware and software for supporting communications between two or more computing devices including, but not limited to, the clients **706** and the application servers **708**. It should be appreciated that the network interfaces **712** also may be utilized to connect to other types of networks and/or computer systems.

It should be understood that the distributed computing environment **700** described herein can provide any aspects of the software elements described herein with any number of virtual computing resources and/or other distributed computing functionality that can be configured to execute any aspects of the software components disclosed herein. According to various implementations of the concepts and technologies disclosed herein, the distributed computing environment **700** provides the software functionality described herein as a service to the clients **706**. It should be understood that the clients **706** can include real or virtual machines including, but not limited to, server computers, web servers, personal computers, mobile computing devices, smart phones, and/or other devices. As such, various embodiments of the concepts and technologies disclosed herein enable any device configured to access the distributed computing environment **700** to utilize the functionality described herein for creating variations when transforming data into consumable content.

Turning now to FIG. **8**, an illustrative computing device architecture **800** for a computing device that is capable of executing various software components described herein for creating variations when transforming data into consumable content. The computing device architecture **800** is applicable to computing devices that facilitate mobile computing due, in part, to form factor, wireless connectivity, and/or battery-powered operation. In some embodiments, the computing devices include, but are not limited to, mobile telephones, tablet devices, slate devices, portable video game devices, and the like. Moreover, the computing device architecture **800** is applicable to any of the clients **806** shown in FIG. **7**. Furthermore, aspects of the computing device architecture **800** may be applicable to traditional desktop computers, portable computers (e.g., laptops, notebooks, ultra-portables, and netbooks), server computers, and other computer systems, such as described herein with reference to FIG. **8**. For example, the single touch and multi-touch aspects disclosed herein below may be applied to desktop computers that utilize a touchscreen or some other touch-enabled device, such as a touch-enabled track pad or touch-enabled mouse.

The computing device architecture **800** illustrated in FIG. **8** includes a processor **802**, memory components **804**, network connectivity components **806**, sensor components **808**, input/output components **810**, and power components **812**. In the illustrated embodiment, the processor **802** is in communication with the memory components **804**, the network connectivity components **806**, the sensor components **808**, the input/output ("I/O") components **810**, and the power components **812**. Although no connections are shown between the individuals components illustrated in FIG. **8**, the components can interact to carry out device functions. In some embodiments, the components are arranged so as to communicate via one or more busses (not shown).

The processor **802** includes a central processing unit ("CPU") configured to process data, execute computer-executable instructions of one or more application programs, and communicate with other components of the computing device architecture **800** in order to perform various functionality described herein. The processor **802** may be utilized to execute aspects of the software components presented herein and, particularly, those that utilize, at least in part, a touch-enabled input.

In some embodiments, the processor **802** includes a graphics processing unit ("GPU") configured to accelerate operations performed by the CPU, including, but not limited to, operations performed by executing general-purpose scientific and engineering computing applications, as well as graphics-intensive computing applications such as high resolution video (e.g., 720P, 1080P, and greater), video games, three-dimensional ("3D") modeling applications, and the like. In some embodiments, the processor **802** is configured to communicate with a discrete GPU (not shown). In any case, the CPU and GPU may be configured in accordance with a co-processing CPU/GPU computing model, wherein the sequential part of an application executes on the CPU and the computationally-intensive part is accelerated by the GPU.

In some embodiments, the processor **802** is, or is included in, a system-on-chip ("SoC") along with one or more of the other components described herein below. For example, the SoC may include the processor **802**, a GPU, one or more of the network connectivity components **806**, and one or more of the sensor components **808**. In some embodiments, the processor **802** is fabricated, in part, utilizing a package-on-package ("PoP") integrated circuit packaging technique. Moreover, the processor **802** may be a single core or multi-core processor.

The processor **802** may be created in accordance with an ARM architecture, available for license from ARM HOLDINGS of Cambridge, United Kingdom. Alternatively, the processor **802** may be created in accordance with an ×86 architecture, such as is available from INTEL CORPORATION of Mountain View, Calif. and others. In some embodiments, the processor **802** is a SNAPDRAGON SoC, available from QUALCOMM of San Diego, Calif., a TEGRA SoC, available from NVIDIA of Santa Clara, Calif., a HUMMINGBIRD SoC, available from SAMSUNG of Seoul, South Korea, an Open Multimedia Application Platform ("OMAP") SoC,

available from TEXAS INSTRUMENTS of Dallas, Tex., a customized version of any of the above SoCs, or a proprietary SoC.

The memory components **804** include a random access memory ("RAM") **814**, a read-only memory ("ROM") **816**, an integrated storage memory ("integrated storage") **818**, and a removable storage memory ("removable storage") **820**. In some embodiments, the RAM **814** or a portion thereof, the ROM **816** or a portion thereof, and/or some combination the RAM **814** and the ROM **816** is integrated in the processor **802**. In some embodiments, the ROM **816** is configured to store a firmware, an operating system or a portion thereof (e.g., operating system kernel), and/or a bootloader to load an operating system kernel from the integrated storage **818** or the removable storage **820**.

The integrated storage **818** can include a solid-state memory, a hard disk, or a combination of solid-state memory and a hard disk. The integrated storage **818** may be soldered or otherwise connected to a logic board upon which the processor **802** and other components described herein also may be connected. As such, the integrated storage **818** is integrated in the computing device. The integrated storage **818** is configured to store an operating system or portions thereof, application programs, data, and other software components described herein.

The removable storage **820** can include a solid-state memory, a hard disk, or a combination of solid-state memory and a hard disk. In some embodiments, the removable storage **820** is provided in lieu of the integrated storage **818**. In other embodiments, the removable storage **820** is provided as additional optional storage. In some embodiments, the removable storage **820** is logically combined with the integrated storage **818** such that the total available storage is made available and shown to a user as a total combined capacity of the integrated storage **818** and the removable storage **820**.

The removable storage **820** is configured to be inserted into a removable storage memory slot (not shown) or other mechanism by which the removable storage **820** is inserted and secured to facilitate a connection over which the removable storage **820** can communicate with other components of the computing device, such as the processor **802**. The removable storage **820** may be embodied in various memory card formats including, but not limited to, PC card, CompactFlash card, memory stick, secure digital ("SD"), miniSD, microSD, universal integrated circuit card ("UICC") (e.g., a subscriber identity module ("SIM") or universal SIM ("USIM")), a proprietary format, or the like.

It can be understood that one or more of the memory components **804** can store an operating system. According to various embodiments, the operating system includes, but is not limited to, SYMBIAN OS from SYMBIAN LIMITED, WINDOWS MOBILE OS from Microsoft Corporation of Redmond, Wash., WINDOWS PHONE OS from Microsoft Corporation, WINDOWS from Microsoft Corporation, PALM WEBOS from Hewlett-Packard Company of Palo Alto, Calif., BLACKBERRY OS from Research In Motion Limited of Waterloo, Ontario, Canada, IOS from Apple Inc. of Cupertino, Calif., and ANDROID OS from Google Inc. of Mountain View, California. Other operating systems are contemplated.

The network connectivity components **806** include a wireless wide area network component ("WWAN component") **822**, a wireless local area network component ("WLAN component") **824**, and a wireless personal area network component ("WPAN component") **826**. The network connectivity components **806** facilitate communications to and from a network **828**, which may be a WWAN, a WLAN, or a WPAN. Although a single network **828** is illustrated, the network connectivity components **806** may facilitate simultaneous communication with multiple networks. For example, the network connectivity components **806** may facilitate simultaneous communications with multiple networks via one or more of a WWAN, a WLAN, or a WPAN.

In some embodiments, the functionality of the network **828** is provided by one or more of the networks **104**, **704**. In some embodiments, the network **828** includes one or more of the networks **104**, **704**. In some other embodiments, the network **828** provides access to one or more of the networks **104**, **704**.

The network **828** may be a WWAN, such as a mobile telecommunications network utilizing one or more mobile telecommunications technologies to provide voice and/or data services to a computing device utilizing the computing device architecture **800** via the WWAN component **822**. The mobile telecommunications technologies can include, but are not limited to, Global System for Mobile communications ("GSM"), Code Division Multiple Access ("CDMA") ONE, CDMA2000, Universal Mobile Telecommunications System ("UMTS"), Long Term Evolution ("LTE"), and Worldwide Interoperability for Microwave Access ("WiMAX"). Moreover, the network **828** may utilize various channel access methods (which may or may not be used by the aforementioned standards) including, but not limited to, Time Division Multiple Access ("TDMA"), Frequency Division Multiple Access ("FDMA"), CDMA, wideband CDMA ("W-CDMA"), Orthogonal Frequency Division Multiplexing ("OFDM"), Space Division Multiple Access ("SDMA"), and the like. Data communications may be provided using General Packet Radio Service ("GPRS"), Enhanced Data rates for Global Evolution ("EDGE"), the High-Speed Packet Access ("HSPA") protocol family including High-Speed Downlink Packet Access ("HSDPA"), Enhanced Uplink ("EUL") or otherwise termed High-Speed Uplink Packet Access ("HSUPA"), Evolved HSPA ("HSPA+"), LTE, and various other current and future wireless data access standards. The network **828** may be configured to provide voice and/or data communications with any combination of the above technologies. The network **828** may be configured to or adapted to provide voice and/or data communications in accordance with future generation technologies.

In some embodiments, the WWAN component **822** is configured to provide dual- multi-mode connectivity to the network **828**. For example, the WWAN component **822** may be configured to provide connectivity to the network **828**, wherein the network **828** provides service via GSM and UMTS technologies, or via some other combination of technologies. Alternatively, multiple WWAN components **822** may be utilized to perform such functionality, and/or provide additional functionality to support other non-compatible technologies (i.e., incapable of being supported by a single WWAN component). The WWAN component **822** may facilitate similar connectivity to multiple networks (e.g., a UMTS network and an LTE network).

The network **828** may be a WLAN operating in accordance with one or more Institute of Electrical and Electronic Engineers ("IEEE") 802.11 standards, such as IEEE 802.11a, 802.11b , 802.11g, 802.11n, and/or future 802.11 standard (referred to herein collectively as WI-FI). Draft 802.11 standards are also contemplated. In some embodiments, the WLAN is implemented utilizing one or more wireless WI-FI access points. In some embodiments, one or more of the wireless WI-FI access points are another computing device with connectivity to a WWAN that are functioning as a WI-FI hotspot. The WLAN component **824** is configured to connect to the network **828** via the WI-FI access points. Such connec-

tions may be secured via various encryption technologies including, but not limited, WI-FI Protected Access ("WPA"), WPA2, Wired Equivalent Privacy ("WEP"), and the like.

The network **828** may be a WPAN operating in accordance with Infrared Data Association ("IrDA"), BLUETOOTH, wireless Universal Serial Bus ("USB"), Z-Wave, ZIGBEE, or some other short-range wireless technology. In some embodiments, the WPAN component **826** is configured to facilitate communications with other devices, such as peripherals, computers, or other computing devices via the WPAN.

The sensor components **808** include a magnetometer **830**, an ambient light sensor **832**, a proximity sensor **834**, an accelerometer **836**, a gyroscope **838**, and a Global Positioning System sensor ("GPS sensor") **840**. It is contemplated that other sensors, such as, but not limited to, temperature sensors or shock detection sensors, also may be incorporated in the computing device architecture **800**.

The magnetometer **830** is configured to measure the strength and direction of a magnetic field. In some embodiments the magnetometer **830** provides measurements to a compass application program stored within one of the memory components **804** in order to provide a user with accurate directions in a frame of reference including the cardinal directions, north, south, east, and west. Similar measurements may be provided to a navigation application program that includes a compass component. Other uses of measurements obtained by the magnetometer **830** are contemplated.

The ambient light sensor **832** is configured to measure ambient light. In some embodiments, the ambient light sensor **832** provides measurements to an application program stored within one the memory components **804** in order to automatically adjust the brightness of a display (described below) to compensate for low-light and high-light environments. Other uses of measurements obtained by the ambient light sensor **832** are contemplated.

The proximity sensor **834** is configured to detect the presence of an object or thing in proximity to the computing device without direct contact. In some embodiments, the proximity sensor **834** detects the presence of a user's body (e.g., the user's face) and provides this information to an application program stored within one of the memory components **804** that utilizes the proximity information to enable or disable some functionality of the computing device. For example, a telephone application program may automatically disable a touchscreen (described below) in response to receiving the proximity information so that the user's face does not inadvertently end a call or enable/disable other functionality within the telephone application program during the call. Other uses of proximity as detected by the proximity sensor **834** are contemplated.

The accelerometer **836** is configured to measure proper acceleration. In some embodiments, output from the accelerometer **836** is used by an application program as an input mechanism to control some functionality of the application program. For example, the application program may be a video game in which a character, a portion thereof, or an object is moved or otherwise manipulated in response to input received via the accelerometer **836**. In some embodiments, output from the accelerometer **836** is provided to an application program for use in switching between landscape and portrait modes, calculating coordinate acceleration, or detecting a fall. Other uses of the accelerometer **836** are contemplated.

The gyroscope **838** is configured to measure and maintain orientation. In some embodiments, output from the gyroscope **838** is used by an application program as an input mechanism to control some functionality of the application program. For example, the gyroscope **838** can be used for accurate recognition of movement within a 3D environment of a video game application or some other application. In some embodiments, an application program utilizes output from the gyroscope **838** and the accelerometer **836** to enhance control of some functionality of the application program. Other uses of the gyroscope **838** are contemplated.

The GPS sensor **840** is configured to receive signals from GPS satellites for use in calculating a location. The location calculated by the GPS sensor **840** may be used by any application program that requires or benefits from location information. For example, the location calculated by the GPS sensor **840** may be used with a navigation application program to provide directions from the location to a destination or directions from the destination to the location. Moreover, the GPS sensor **840** may be used to provide location information to an external location-based service, such as E911 service. The GPS sensor **840** may obtain location information generated via WI-FI, WIMAX, and/or cellular triangulation techniques utilizing one or more of the network connectivity components **806** to aid the GPS sensor **840** in obtaining a location fix. The GPS sensor **840** may also be used in Assisted GPS ("A-GPS") systems.

The I/O components **810** include a display **842**, a touchscreen **844**, a data I/O interface component ("data I/O") **846**, an audio I/O interface component ("audio I/O") **848**, a video I/O interface component ("video I/O") **850**, and a camera **852**. In some embodiments, the display **842** and the touchscreen **844** are combined. In some embodiments two or more of the data I/O component **846**, the audio I/O component **848**, and the video I/O component **850** are combined. The I/O components **810** may include discrete processors configured to support the various interface described below, or may include processing functionality built-in to the processor **802**.

The display **842** is an output device configured to present information in a visual form. In particular, the display **842** may present graphical user interface ("GUI") elements, text, images, video, notifications, virtual buttons, virtual keyboards, messaging data, Internet content, device status, time, date, calendar data, preferences, map information, location information, and any other information that is capable of being presented in a visual form. In some embodiments, the display **842** is a liquid crystal display ("LCD") utilizing any active or passive matrix technology and any backlighting technology (if used). In some embodiments, the display **842** is an organic light emitting diode ("OLED") display. Other display types are contemplated.

The touchscreen **844** is an input device configured to detect the presence and location of a touch. The touchscreen **844** may be a resistive touchscreen, a capacitive touchscreen, a surface acoustic wave touchscreen, an infrared touchscreen, an optical imaging touchscreen, a dispersive signal touchscreen, an acoustic pulse recognition touchscreen, or may utilize any other touchscreen technology. In some embodiments, the touchscreen **844** is incorporated on top of the display **842** as a transparent layer to enable a user to use one or more touches to interact with objects or other information presented on the display **842**. In other embodiments, the touchscreen **844** is a touch pad incorporated on a surface of the computing device that does not include the display **842**. For example, the computing device may have a touchscreen incorporated on top of the display **842** and a touch pad on a surface opposite the display **842**.

In some embodiments, the touchscreen **844** is a single-touch touchscreen. In other embodiments, the touchscreen **844** is a multi-touch touchscreen. In some embodiments, the

touchscreen **844** is configured to detect discrete touches, single touch gestures, and/or multi-touch gestures. These are collectively referred to herein as gestures for convenience. Several gestures will now be described. It should be understood that these gestures are illustrative and are not intended to limit the scope of the appended claims. Moreover, the described gestures, additional gestures, and/or alternative gestures may be implemented in software for use with the touchscreen **844**. As such, a developer may create gestures that are specific to a particular application program.

In some embodiments, the touchscreen **844** supports a tap gesture in which a user taps the touchscreen **844** once on an item presented on the display **842**. The tap gesture may be used for various reasons including, but not limited to, opening or launching whatever the user taps. In some embodiments, the touchscreen **844** supports a double tap gesture in which a user taps the touchscreen **844** twice on an item presented on the display **842**. The double tap gesture may be used for various reasons including, but not limited to, zooming in or zooming out in stages. In some embodiments, the touchscreen **844** supports a tap and hold gesture in which a user taps the touchscreen **844** and maintains contact for at least a predefined time. The tap and hold gesture may be used for various reasons including, but not limited to, opening a context-specific menu.

In some embodiments, the touchscreen **844** supports a pan gesture in which a user places a finger on the touchscreen **844** and maintains contact with the touchscreen **844** while moving the finger on the touchscreen **844**. The pan gesture may be used for various reasons including, but not limited to, moving through screens, images, or menus at a controlled rate. Multiple finger pan gestures are also contemplated. In some embodiments, the touchscreen **844** supports a flick gesture in which a user swipes a finger in the direction the user wants the screen to move. The flick gesture may be used for various reasons including, but not limited to, scrolling horizontally or vertically through menus or pages. In some embodiments, the touchscreen **844** supports a pinch and stretch gesture in which a user makes a pinching motion with two fingers (e.g., thumb and forefinger) on the touchscreen **844** or moves the two fingers apart. The pinch and stretch gesture may be used for various reasons including, but not limited to, zooming gradually in or out of a website, map, or picture.

Although the above gestures have been described with reference to the use one or more fingers for performing the gestures, other appendages such as toes or objects such as styluses may be used to interact with the touchscreen **844**. As such, the above gestures should be understood as being illustrative and should not be construed as being limiting in any way.

The data I/O interface component **846** is configured to facilitate input of data to the computing device and output of data from the computing device. In some embodiments, the data I/O interface component **846** includes a connector configured to provide wired connectivity between the computing device and a computer system, for example, for synchronization operation purposes. The connector may be a proprietary connector or a standardized connector such as USB, micro-USB, mini-USB, or the like. In some embodiments, the connector is a dock connector for docking the computing device with another device such as a docking station, audio device (e.g., a digital music player), or video device.

The audio I/O interface component **848** is configured to provide audio input and/or output capabilities to the computing device. In some embodiments, the audio I/O interface component **846** includes a microphone configured to collect audio signals. In some embodiments, the audio I/O interface component **846** includes a headphone jack configured to provide connectivity for headphones or other external speakers. In some embodiments, the audio interface component **848** includes a speaker for the output of audio signals. In some embodiments, the audio I/O interface component **846** includes an optical audio cable out.

The video I/O interface component **850** is configured to provide video input and/or output capabilities to the computing device. In some embodiments, the video I/O interface component **850** includes a video connector configured to receive video as input from another device (e.g., a video media player such as a DVD or BLURAY player) or send video as output to another device (e.g., a monitor, a television, or some other external display). In some embodiments, the video I/O interface component **850** includes a High-Definition Multimedia Interface ("HDMI"), mini-HDMI, micro-HDMI, DisplayPort, or proprietary connector to input/output video content. In some embodiments, the video I/O interface component **850** or portions thereof is combined with the audio I/O interface component **848** or portions thereof.

The camera **852** can be configured to capture still images and/or video. The camera **852** may utilize a charge coupled device ("CCD") or a complementary metal oxide semiconductor ("CMOS") image sensor to capture images. In some embodiments, the camera **852** includes a flash to aid in taking pictures in low-light environments. Settings for the camera **852** may be implemented as hardware or software buttons.

Although not illustrated, one or more hardware buttons may also be included in the computing device architecture **800**. The hardware buttons may be used for controlling some operational aspect of the computing device. The hardware buttons may be dedicated buttons or multi-use buttons. The hardware buttons may be mechanical or sensor-based.

The illustrated power components **812** include one or more batteries **854**, which can be connected to a battery gauge **856**. The batteries **854** may be rechargeable or disposable. Rechargeable battery types include, but are not limited to, lithium polymer, lithium ion, nickel cadmium, and nickel metal hydride. Each of the batteries **854** may be made of one or more cells.

The battery gauge **856** can be configured to measure battery parameters such as current, voltage, and temperature. In some embodiments, the battery gauge **856** is configured to measure the effect of a battery's discharge rate, temperature, age and other factors to predict remaining life within a certain percentage of error. In some embodiments, the battery gauge **856** provides measurements to an application program that is configured to utilize the measurements to present useful power management data to a user. Power management data may include one or more of a percentage of battery used, a percentage of battery remaining, a battery condition, a remaining time, a remaining capacity (e.g., in watt hours), a current draw, and a voltage.

The power components **812** may also include a power connector, which may be combined with one or more of the aforementioned I/O components **810**. The power components **812** may interface with an external power system or charging equipment via a power I/O component **844**.

Based on the foregoing, it should be appreciated that technologies for creating variations when transforming data into consumable content have been disclosed herein. Although the subject matter presented herein has been described in language specific to computer structural features, methodological and transformative acts, specific computing machinery, and computer readable media, it is to be understood that the invention defined in the appended claims is not necessarily limited to the specific features, acts, or media described

herein. Rather, the specific features, acts and mediums are disclosed as example forms of implementing the claims.

The subject matter described above is provided by way of illustration only and should not be construed as limiting. Various modifications and changes may be made to the subject matter described herein without following the example embodiments and applications illustrated and described, and without departing from the true spirit and scope of the present invention, which is set forth in the following claims.

We claim:

1. A computer-implemented method for transforming data, the computer-implemented method comprising performing computer-implemented operations for:

obtaining, at a computing device, data comprising a plurality of data elements;

analyzing the data to identify relationships between the plurality of data elements;

identifying a plurality of worlds that can be used to generate output comprising at least one of the plurality of data elements, each of the plurality of worlds defining a visualization model to apply to the plurality of data elements based, at least partially, upon the relationships;

ranking the plurality of worlds based, at least partially, upon a determination of an appropriateness of the each of the plurality of worlds for a shape determined for the data;

selecting a world from the plurality of worlds based, at least partially, upon the data;

obtaining rules for applying the data to the world selected; and

applying the rules to the data to generate the output.

2. The method of claim **1**, further comprising:

presenting the output at a display device associated with the computing device;

obtaining feedback from a user of the computing device;

determining, if the world is to be changed based, at least partially, upon the feedback; and

in response to determining that the world is to be changed, selecting a new world in accordance with the feedback.

3. The method of claim **1**, further comprising:

determining at least one variation to apply to the plurality of data elements for introducing a variation to the output;

determining the visualization model based upon the variation and the relationships; and

selecting the world based, at least partially, upon the visualization model and the relationships.

4. The method of claim **1**, wherein identifying the plurality of worlds comprises analyzing the data to determine worlds to which the data can be applied based, at least partially, upon the shape determined for the data.

5. The method of claim **4**, wherein the shape determined for the data comprises data identifying at least one of an amount of text, an amount of images in the data, or an amount of another type of data.

6. The method of claim **4**, wherein selecting a world from the plurality of worlds comprises:

selecting the world based, at least partially, upon the ranking; and

outputting the selected world.

7. The method of claim **6**, wherein selecting the world comprises selecting the world having the highest ranking.

8. A computer storage medium having computer readable instructions stored thereupon that, when executed by a computer, cause the computer to:

obtain data comprising a plurality of data elements;

analyze the data to identify relationships between the plurality of data elements;

identify a plurality of worlds that can be used to generate output comprising at least one of the plurality of data elements based, at least partially, upon the relationships, wherein each of the plurality of worlds defines a visualization model to apply to the plurality of data elements;

rank each of the plurality of worlds based, at least partially, upon a determination of an applicability of the world to a shape determined for the data;

select a world from the plurality of worlds based, at least partially, upon the data and the relationships;

obtain rules for applying the data to the world; and

apply the rules to the data to generate the output.

9. The computer storage medium of claim **8**, further comprising computer readable instructions that, when executed by the computer, cause the computer to identify the plurality of worlds by analyzing the data to determine worlds to which the data can be applied based, at least partially, upon the shape determined for the data.

10. The computer storage medium of claim **9**, wherein the shape determined for the data comprises data identifying at least one of an amount of text in the data, an amount of images in the data, an image to text ratio associated with the data, an average image size associated with the data, or a size of text blocks within the data.

11. The computer storage medium of claim **9**, wherein the shape determined for the data further comprises at least one of an amount of images in the data, a size of images in the data, a resolution of images in the data, an aspect ratio of images in the data, a length of text blocks in the data, numbers of related text blocks in the data, or counts of sections in the data.

12. The computer storage medium of claim **9**, further comprising computer readable instructions that, when executed by the computer, cause the computer to select a world from the plurality of worlds by:

selecting the world based, at least partially, upon the ranking; and

outputting the selected world.

13. The computer storage medium of claim **8**, further comprising computer readable instructions that, when executed by the computer, cause the computer to:

present the output; and

obtain feedback relating to the output.

14. The computer storage medium of claim **13**, further comprising computer readable instructions that, when executed by the computer, cause the computer to:

determine, based upon the feedback, if the world is to be changed; and

in response to determining that the world is to be changed, determine a new world to apply the data to and output data identifying the new world determined.

15. The computer storage medium of claim **14**, further comprising computer readable instructions that, when executed by the computer, cause the computer to determine if the world is to be changed by:

reranking the plurality of worlds; and

selecting the new world based, at least partially, upon the reranking of the plurality of worlds.

16. The computer storage medium of claim **13**, wherein the feedback comprises at least one of:

an indication that an aspect of the output is liked;

an indication that an aspect of the output is disliked; or

an indication that a different world is desired.

17. A computer storage medium having computer readable instructions stored thereupon that, when executed by a computer, cause the computer to:

obtain data comprising a plurality of data elements;

analyze the data to identify relationships between the plurality of data elements;

identify a plurality of worlds that can be used to generate output comprising at least one of the plurality of data elements based, at least partially, upon the relationships, wherein each of the plurality of worlds defines a visualization model to apply to the plurality of data elements;

rank each of the plurality of worlds to determine a ranking of the worlds based, at least partially, upon a determination of an applicability of the world to the data the relationships;

select a world from the plurality of worlds based, at least partially, upon the ranking of the worlds;

obtain rules for applying the data to the world selected; and

apply the rules to the data to generate the output.

18. The computer storage medium of claim **17**, further comprising computer readable instructions that, when executed by the computer, cause the computer to:

present the output;

obtain feedback relating to the output;

determine, based upon the feedback, if the world is to be changed; and

in response to determining that the world is to be changed, determine a new world to apply the data to and output data identifying the new world determined.

19. The computer storage medium of claim **17**, further comprising computer readable instructions that, when executed by the computer, cause the computer to:

determine that the data has been updated; and

update the output to reflect the updated data.

20. The method of claim **1**, further comprising:

detecting a change to the data or new data;

reranking the plurality of worlds based on the change to the data or the new data; and

selecting a new world based on the reranking of the plurality of worlds based on the change to the data or the new data.

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